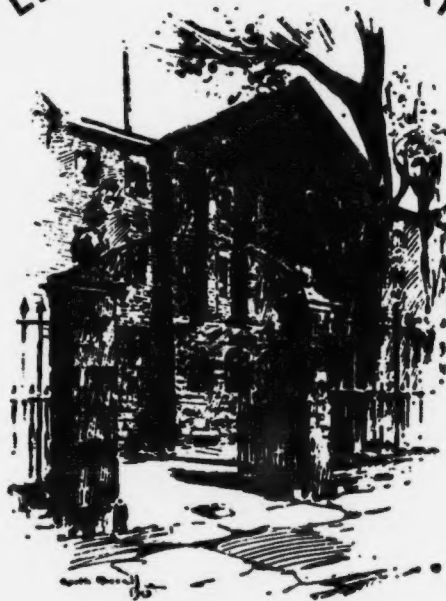


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FRAZEE & WHISTON'S

COMMERCIAL ARITHMETIC.

Elisha Ryer

BY
J. C. P. Frazee

J. C. P. FRAZEE,
ASSOCIATE PRINCIPAL OF THE HALIFAX BUSINESS COLLEGE.

HALIFAX, N. S.:
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PREFACE.

THE author of this work desires only to say to such of the public as may feel an interest in it, that he has prepared it principally for use in the Halifax Business College, and has consulted only the requirements and interests of that institution in its preparation. That he lays no claim to literary merit for the work ; nor has he always confined himself to the insertion of purely original matter. The subject is so old, and so much the common property of so many authors, that about the only originality any one can lay claim to in such a work is his manner of presenting the subject. Some of the material of Eaton & Frazee's Arithmetic, now out of print, has been appropriated. Many other works have been consulted, and occasional exercises, modified to suit the requirements of this work, have been used.

The author's thanks are due, and are here tendered, to several practical accountants and business men of Halifax for valuable information and assistance, always cheerfully rendered when asked for.

HALIFAX, N. S.,

December, 1883.

1845

1. The first of the year was a very cold one, with much snow and ice. The weather was very disagreeable, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks. The winter was very severe, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks.

2. The second of the year was a very cold one, with much snow and ice. The weather was very disagreeable, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks. The winter was very severe, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks.

3. The third of the year was a very cold one, with much snow and ice. The weather was very disagreeable, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks. The winter was very severe, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks.

4. The fourth of the year was a very cold one, with much snow and ice. The weather was very disagreeable, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks. The winter was very severe, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks.

5. The fifth of the year was a very cold one, with much snow and ice. The weather was very disagreeable, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks. The winter was very severe, and the people were much distressed. The crops were all killed, and the people were forced to live on their stocks.

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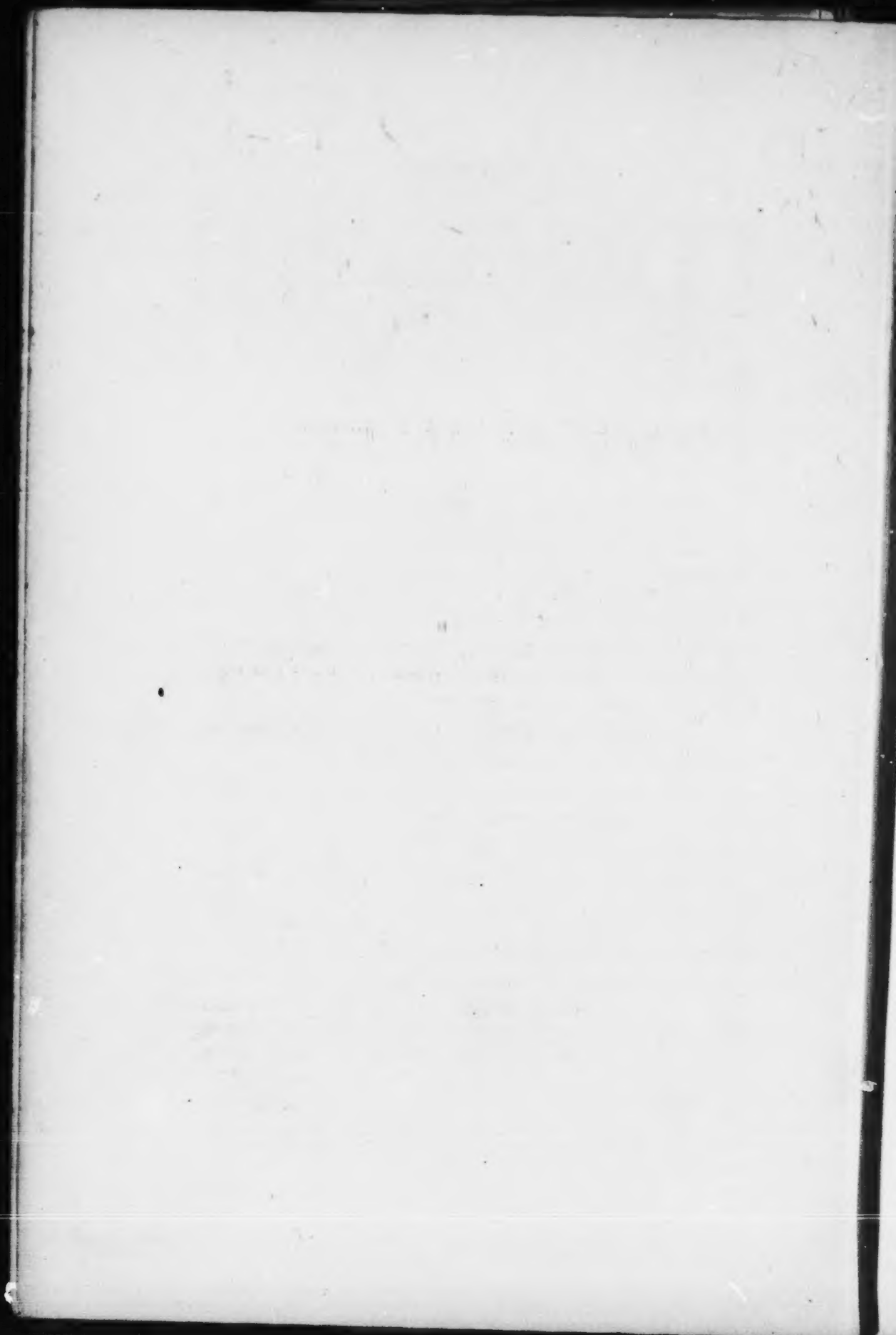
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COMMERCIAL ARITHMETIC.

PRELIMINARY EXERCISES.

1. I have in my desk \$43; my neighbor, A, owes me \$8; B owes me \$147; C, \$409; D, \$649; E, \$961; F, \$91; how many dollars will I have if they all pay me?
2. Last night I had \$2308; to-day I received nothing, but paid away \$973; how many dollars have I left?
3. A farmer gathered from his orchard 1083 bushels of apples and sold 558 bushels; how many bushels had he left?
4. How much did the 558 bushels bring @ \$2 per bushel?
5. A farmer fattened and took to market 7 hogs; one weighed 163 pounds, another 270 pounds, another 328 pounds, another 197 pounds, another 449 pounds, another 95 pounds, and another 256 pounds; how many pounds of pork did he have to sell?
6. How much are 1758 lb. of pork worth @ 7 cents per lb.
7. A wholesale merchant received 8 notes from his customers in one day; the 1st was for \$725, the 2nd for \$197, the 3rd for \$75, the 4th for \$19, the 5th for \$473, the 6th for \$690, the 7th for \$84, and the 8th for \$69; what was the value of the whole?
8. In 1871, the population of Nova Scotia was 387800, and that of New Brunswick was 285594, how many more people were there in Nova Scotia than in New Brunswick?

9. If a man were worth \$3112 on new year's day, and gained during the year \$849, how much would he be worth the next new year's day?

10. If a man were worth \$4000 on new year's day, and lost \$1943 during the year, how much would he be worth the next new year's day?

11. A man intending to move from the country to the city sold his farm for \$1743, his horses for \$395, his cows for \$98, his sheep for \$137, his farming utensils for \$249, his hay for \$217, his grain for \$75, and his poultry for \$29, how many dollars worth did he sell altogether?

12. In the last question how much more did the man get for his hay than for his grain?

13. In 1871 the population of the counties of New Brunswick was as follows: St. John, 52120; Charlotte, 25882; King's, 24593; Queen's, 13847; Sunbury, 6824; York, 27140; Carleton, 19938; Victoria, 11641; Restigouche, 5575; Gloucester, 18810; Northumberland, 20116; Kent, 19101; Westmoreland, 29335; Albert, 10672; what was the population of the whole Province?

14. If one yard of cloth cost 75 cents, how many cents will 25 yards cost?

15. If 1 pound of cheese cost 18 cents, how many cents must I give for 9 pounds?

16. If 7 boxes contain 144 pens each, how many in them all?

17. If a laborer earn \$7 a week, how many dollars would he earn in 35 weeks?

18. How many bricks would a teamster remove at 23 loads, if he took 1625 at a load?

19. If a wagon wheel make 586 revolutions in a mile, how many revolutions would it make in a journey of 67 miles?

20. An ordinary clock strikes 156 strokes in a day, how many strokes does it strike in a year of 365 days?

21. A bushel of potatoes weighs 60 pounds, what is the weight of 350 bushels?

22. At \$15 per acre, what would be the price of a field measuring 29 acres?

PRELIMINARY EXERCISES.

3

23. If an acre of land yield 47 bushels of wheat, how many bushels will 109 acres yield?
24. What is the half of 9786?
25. What is the one-third of 768594?
26. Find one-eighth of 673915.
27. Find one-fortieth of 976183.
28. If 5 barrels of apples cost \$20, what is the price of one barrel?
29. If a clock strike 1092 strokes in a week, how many strokes does it strike each day?
30. If 19 yds. of cloth cost 1805 cents, what is the price per yard?
31. If an orchard of 27 trees produce 5103 apples, how many is that per tree, on an average?
32. If 56 men earn \$30072 in a year, what is the salary of each man, on an average?
33. If there be 54432 pens in 378 boxes of equal size, how many in each box?
34. How many acres in a field which produces 4277 bushels of oats, at the rate of 29 bushels per acre?
35. If each family in a city consume 72 eggs in a year, and it require 1,229,688 eggs to supply the city, how many families are there in the city.
36. If 379 bushels of corn cost 13265 cents, how much is that per bushel?
37. What is the cost of 17 acres of land at \$52.50 per acre?
38. A hammer factory turns out 37440 hammers in a year of 52 weeks, how many is that per week, on an average?
39. How many yards of calico @ 8 cents per yard can I buy for \$2.80?
40. How many yards of ribbon @ 25 cents per yard can be purchased for \$32?
41. I sold 15 tubs of butter, each containing 25 lb., for \$60, how much was that per pound?

42. Bought 21 barrels of apples @ \$1.05 per barrel, what did they cost me?
43. If 11 tons of hay cost \$214.50, what will 1 ton cost? What will 27 tons cost?
44. 1125 bbls. fish were sold for \$5906.25, how much per barrel?
45. 269 persons pay a tax of \$1312.72, what is the average tax on each?
46. Suppose a manufacturing company employs 250 men, and pays them on an average \$1.75 per day, what is the cost to the company for 1 day? for 1 week? for 1 year?
47. If the houses in a town are worth on an average \$950 each, and their total value is \$1168500, how many houses are in the town?
48. If the total value of 1230 houses be \$1039350, what is the value of each house on an average?
49. What would be the total value of 1230 houses, if the average value were \$845 each?
50. What is the value of 437 sheep at \$4.75 each?
51. If a man travel 3 miles an hour every day for 40 days of 12 hours each, how many miles will he travel.
52. If a railway train runs 264 miles in 12 hours, what is the average rate per hour?
53. At 45 cents per bushel, what must be paid for 1195 bushels of potatoes?
54. A cargo of 4700 bushels oats sold for \$1504, how much is that per bushel?
55. What is the weight of a cargo of 5000 bushels of wheat weighing 60 lbs. per bushel.
56. 180 chaldrons of coal were sold for \$1035, what was the price of 1 chaldron?

NUMERATION.

Numeration is the art of reading numbers expressed by figures, or letters.

There are two methods of Numeration, the **French** and the **English**.

The **French** method is almost universally used: It separates the figures into groups of three figures each, called periods, with a distinct name to each period.

FRENCH NUMERATION TABLE.

Hundreds of Trillions. Tens of Trillions. Trillions.	Hundreds of Billions. Tens of Billions. Billions.	Hundreds of Millions. Tens of Millions. Millions.	Hundreds of Thousands. Tens of Thousands. Thousands.	Hundreds. Tens. Units.
5th Period. Trillions.	4th Period. Billions.	3rd Period. Millions.	2nd Period. Thousands.	1st Period. Units.

The periods above Trillions are Quadrillions, Quintillions, Sextillions, Septillions, Octillions, Nonillions, Decillions, Undecillions, Duodecillions, Tredecillions, &c.

In the English method, which is seldom used, the figures are separated into periods of six places each. The first period is regarded as units and thousands of units; the second, as millions and thousands of millions; the third, as billions and thousands of billions, and so on.

RULE FOR NUMERATION.—*Begin at the right, and point off in periods of three figures each; then, begin at the left and read in succession each period with its name.*

NOTATION.

EXERCISES IN NUMERATION.

EXAMPLE.—368271927. Read thus:—

Three hundred
and
sixty
eight
millions,
two hundred
and
seventy
one thousand,
nine hundred
and
twenty
seven.

125.	58763.	25643287.
372.	86552.	87418389.
864.	155731.	234656431.
1076.	196472.	761118445.
1884.	251103.	4519876314.
2750.	564989.	37965432819.
5890.	2285432.	98740811087.
9759.	2711511.	880195038604.
10864.	5318754.	9108630106543.
17651.	9871832.	86419038765789.
42414.	11867438.	386480967318640.

NOTATION.

Notation is the art of writing numbers by figures.

RULE FOR NOTATION.—Write first the figures of the highest period, then of the other periods in their proper succession, filling vacant places with ciphers.

NOTE.—Every period (except sometimes the highest) must have three figures, and if any period is omitted in the given number, its place must be supplied with three ciphers.

EXERCISES IN NOTATION.

Write in figures the following numbers:—

DEFINITIONS.

7 .

1. Forty-six thousand, seven hundred and one.
2. Six thousand, six hundred and sixty.
3. Eight hundred and eighty-eight thousand, eight hundred and eighty-nine.
4. Eight hundred and eighty-eight thousand, eight hundred and nine.
5. Eight hundred thousand and nine.
6. Ten millions, ten thousand and ten.
7. Ten millions and ten.
8. Ninety millions, nine thousand and ninety.
9. Ninety millions, nine hundred and nine.
10. Seven hundred and seventy billions, five thousand and seven.
11. Eleven millions and eleven.
12. Eleven billions, eleven millions, one hundred and eleven.
13. Two trillions, thirty millions and thirty.
14. Nine quadrillions, twenty trillions, five hundred billions, two hundred millions, three thousand and thirty-three.

DEFINITIONS.

Figures are characters representing numbers.

A Digit is a single figure.

An Integer is a whole number.

A Unit is one, or a single thing.

Numbers may be, and are in arithmetical calculations, added, subtracted, multiplied and divided; and these processes are called respectively addition, subtraction, multiplication and division.

These processes are often indicated by signs, as follows:

The sign of addition is $+$, read plus.

The sign of subtraction is $-$, read minus.

The sign of multiplication is $\times$, read multiplied by.

The sign of division is $\div$, read divided by, or the placing of the numbers used in the division in this position, $\frac{1}{2}$, which means

that the upper number is to be divided by the lower number ; or in this position, $4)12$, which means that the number on the right is to be divided by the number on the left.

The **Sum** is the result of addition.

The **Minuend** is a number from which another number is subtracted.

The **Subtrahend** is a number subtracted from another number.

The **Difference** or **Remainder** is the result of subtraction.

The **Multiplicand** is a number multiplied by another number.

The **Multiplier** is a number by which another number is multiplied.

The **Product** is the result of multiplication.

The **Dividend** is a number divided by another number.

The **Divisor** is a number by which another number is divided.

The **Quotient** is the result of division.

PROPERTIES OF NUMBERS.

Every number is either odd or even.

An **Odd Number** is one that cannot be divided by 2 without making a fraction, as, 1, 3, 5, 7, 9, 11, &c.

An **Even Number** is one that can be divided by 2 without making a fraction, as, 2, 4, 6, 8, 10, &c., and therefore 2 will divide evenly into any even number.

3 will divide evenly into any number the sum of whose digits 3 will exactly divide.

4 will exactly divide any number if it will exactly divide the number formed by the two right hand-figures.

5 will divide evenly into any number whose right-hand figure is 5 or 0.

PROPERTIES OF NUMBERS.

9

6 will divide evenly into any even number into which 3 will divide evenly.

8 will divide evenly into any number if it will divide evenly into the number formed by the three right-hand figures.

9 will divide evenly into any number the sum of whose digits it will exactly divide.

10 will divide evenly in any number that ends with a 0.

A number which divides evenly into another number is called a factor of that other number, thus, 4 is a factor of 36, and 7 is a factor of 203.

A **Prime Number** is one that cannot be divided evenly by any whole number except itself or 1, as, 1, 2, 3, 5, 7, 11, 13, 17, 19, &c.

All the prime numbers not larger than 1109 are included in the following

TABLE OF PRIME NUMBERS.

1	59	139	233	337	439	557	653	769	883	1013
2	61	149	239	347	443	563	659	773	887	1019
3	67	151	241	349	445	569	661	787	907	1021
5	71	157	251	353	457	571	673	797	911	1031
7	73	163	257	359	461	577	677	809	919	1033
11	79	167	263	367	463	587	683	811	929	1039
13	83	173	269	373	467	593	691	821	937	1049
17	89	179	271	379	479	599	701	823	941	1051
19	97	181	277	383	487	601	709	827	947	1061
23	101	191	281	389	491	607	719	829	953	1063
29	103	193	283	397	499	613	727	839	967	1069
31	107	197	293	401	503	617	733	853	971	1087
37	109	199	307	409	509	619	739	857	977	1091
41	113	211	311	419	521	631	743	859	983	1093
43	127	223	313	421	523	641	751	863	991	1097
47	131	227	317	431	541	643	757	877	997	1103
53	137	229	331	433	547	647	761	881	1009	1109

A **Composite Number** is one that can be divided evenly by some whole number other than itself, or 1, as 4, 6, 8, 9, 12, 14, 15, &c.

Every composite number is the product of two or more prime numbers.

Two or more numbers are prime to each other when one is the only number which will exactly divide any two of them, as 5, 9, and 16.

A number which will exactly divide two or more numbers is called a **common factor** of them. Thus, 3 is a common factor of 6, 9, 12 and 15. 7 is a common factor of 14 and 35.

PROPERTIES OF NUMBERS.

PRIME FACTORS.

A **Prime Factor** of a number is a prime number which will exactly divide it. Thus, the prime factors of 21 are 3 and 7. The prime factors of 24 are 2, 2, 2, and 3.

To resolve a composite number into its prime factors.

RULE.—Divide the given number by any prime number greater than 1 that will exactly divide it, repeat the process with the quotient, and so on till a prime number is obtained; the divisors and last quotient are the prime factors required.

EXAMPLE.—What are the prime factors of 90?

$$\begin{array}{r} 2)90 \\ 3)45 \\ 3)15 \\ \underline{5} \end{array}$$

Ans. 2, 3, 3, and 5.

EXERCISES.

1. What are the prime factors of 35?
2. What are the prime factors of 75?
3. Resolve 651 into its prime factors.
4. Resolve 1764 into its prime factors.
5. What are the prime factors of 198?
6. What are the prime factors of 171?
7. What are the prime factors of 210?
8. What are the prime factors of 2310?
9. What are the prime factors of 362880?
10. Find the prime factors of 180642.
11. What are the prime factors of 51051?

GREATEST COMMON DIVISOR.

A **Common Divisor** of two or more numbers is a number which will divide each of them without a remainder. Thus, 3 is a common divisor of 12, 18, 24 and 30.

The **Greatest Common Divisor** of two or more numbers is the greatest number that will divide each of them without a remainder. Thus, 4 is the greatest common divisor of 8, 12 and 16.

To find the greatest common divisor of two or more numbers.

RULE 1.—Resolve the given numbers into their prime factors; the product of the factors common to all will be the greatest common divisor.

EXAMPLE.—Find the greatest common divisor of 18, 27 and 36.

$$18 = 2 \times 3 \times 3.$$

$$27 = 3 \times 3 \times 3.$$

$$36 = 2 \times 2 \times 3 \times 3.$$

The prime factors common to all, are 3 and 3. $3 \times 3 = 9$, the greatest common divisor.

EXERCISES.

1. Find the greatest common divisor of 16, 40 and 72.
2. Find the greatest common divisor of 36, 54, 90 and 72.
3. Find the greatest common divisor of 126, 210, 84 and 168.
4. Find the greatest common divisor of 175 and 245.

RULE 2.—If there be only two numbers, divide the greater by the less, that divisor by the remainder, and so on till there is no remainder. The last divisor will be the greatest common divisor.

When there are more than two numbers, find the greatest common divisor of two, then of that and another, and so on to the last. The last greatest common divisor will be the greatest common divisor of the whole.

EXAMPLE.—Find the greatest common divisor of 21 and 98.

$$\begin{array}{r} 21 \overline{)98} 4 \\ \underline{84} \\ 14 \overline{)21} 1 \\ \underline{14} \\ 7 \overline{)14} \\ \underline{14} \\ 0 \end{array}$$

The last divisor, 7, is the greatest common divisor.

EXERCISES.

1. Find the greatest common divisor of 52 and 299.
2. Find the greatest common divisor of 108 and 9342.

PROPERTIES OF NUMBERS.

3. What is the greatest common divisor of 1638 and 2106?
4. What is the greatest common divisor of 31185 and 50457?
5. Required the greatest common divisor of 24, 108 and 464.
6. Required the greatest common divisor of 576, 1344 and 2592.
7. Required the greatest common divisor of 576, 768, 480 and 1360.
8. A gentleman's garden is 162 feet long, and 138 feet wide. He wishes to set posts for fencing at the greatest distance apart that will make equal spaces on all sides. Required the number of feet from centre to centre of posts.

LEAST COMMON MULTIPLE.

A Multiple of a number is a number which can be divided by it without a remainder. Thus, 15 is a multiple of 3; so is 12; so is 21.

A Common Multiple of two or more numbers is a number which can be divided by each of them without a remainder. Thus, 15 is a common multiple of 3 and 5; 24 is a common multiple of 2, 4 and 6.

The **Least Common Multiple** of two or more numbers is the *least* number that can be divided by each of them without a remainder. Thus, 45 is the least common multiple of 5 and 9; 12 is the least common multiple of 2, 4 and 6.

To find the least common multiple of several numbers.

RULE.—Arrange the numbers in a horizontal line, omitting such of them as are factors of any of the others; divide any two or more of them by any prime number that will divide them without a remainder, writing the quotients and undivided numbers in a line below; continue the process till a line is obtained the numbers in which are prime to each other. Multiply together the divisors and the numbers in the last line, and the product will be the least common multiple required.

NOTE 1.—This process gives the product of all the prime factors in the given numbers.

NOTE 2.—If the given numbers are prime to each other, their product is their least common multiple.

LEAST COMMON MULTIPLE.

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EXAMPLE.—What is the least common multiple of 6, 8, 12, and 15. ?

$$\begin{array}{r} 2)8, 12, 15. \\ \hline \end{array}$$

$$\begin{array}{r} 2)4, 6, 15. \\ \hline \end{array}$$

$$\begin{array}{r} 3)2, 3, 15. \\ \hline \end{array}$$

$$\begin{array}{r} 2, 1, 5. \\ \hline \end{array}$$

Omit 6 because it is a factor of 12. The divisors are all prime numbers, and the numbers in the last line are prime to each other. Then $2 \times 2 \times 3 \times 2 \times 5 = 120$, which is the least common multiple of 6, 8, 12 and 15.

EXEROISES.

1. Find the least common multiple of 12, 16, 18, 30 and 48.
2. Find the least common multiple of 3, 4, 5, 6, and 7.
3. What is the least common multiple of 2, 4, 7, 12, 16, 21, and 56 ?
4. What is the least common multiple of 2, 9, 11, and 33
5. Find the least common multiple of 2, 3, 4, 5, 6, 7, 8, and 9.
6. Find the least common multiple of 8, 12, 16, 24, and 33.
7. What is the least number into which 2, 4, 8, 16, 32, 64, and 128 will divide without a remainder.
8. Find the least common multiple of 3, 9, 27, 81, 243 and 729.
9. What is the least common multiple of 2, 3, 5, 7, 11?

FRACTIONS.

A **Fraction** is a part of a unit or whole thing, supposed to be divided into equal parts.

Fractions are divided into two classes, **Common** and **Decimal**.

A **Common Fraction** is expressed by two numbers, one above the other with a horizontal line between them, and these numbers are called the *terms* of the fraction, as $\frac{2}{3}$, read two-thirds.

The term below the line is called the **Denominator**. The term above the line is called the **Numerator**.

The name of a fraction and the value of its parts depend on the number of parts into which the unit is divided. When the unit is divided into 2, 3, 4, 5 or 6 equal parts, the fraction is named halves, thirds, fourths, fifths or sixths, respectively.

The **Denominator** gives a name to the fraction, and shows the number of equal parts into which the unit is divided.

The **Numerator** shows how many of these parts are expressed by the fraction.

Thus, in the expression $\frac{3}{4}$ of a mile, a mile is supposed to be divided into four equal parts, called fourths, three of which are expressed by the fraction, $\frac{3}{4}$.

A fraction is either **Proper** or **Improper**.

A **Proper Fraction** has its numerator less than its denominator, as $\frac{1}{2}$.

An **Improper Fraction** has its numerator equal to, or greater than its denominator, as $\frac{4}{3}$, $\frac{5}{4}$.

A **Mixed Number** is a whole number with a fraction annexed, as $4\frac{1}{2}$.

Again, a Fraction is either **Simple**, **Compound** or **Complex**.

A **Simple Fraction** is one whose numerator and denominator are simple numbers, and it may be proper or improper. Thus, $\frac{3}{8}$ and $\frac{7}{4}$ are both simple fractions.

A **Compound Fraction** is a fraction of a fraction, that is, it is two or more fractions connected by the word "of," as $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{7}{8}$.

A **Complex Fraction** has a fraction in its numerator or denominator, or in both. Thus,

$$\frac{\frac{3}{4}}{\frac{7}{4}}, \frac{\frac{3}{4}}{\frac{4}{3}}, \frac{\frac{8}{3}}{\frac{6}{9}}$$

are all complex fractions.

All common fractions represent division, the numerator being the dividend, and the denominator the divisor. The value of the fraction is the quotient arising from performing the operation of division. Thus, the value of the fraction $\frac{1}{4}$ is 4. When the fraction is proper the division cannot be performed, but is merely indicated, and the quotient can only be expressed in the fractional form.

REDUCTION OF FRACTIONS.

Reduction of Fractions consists in changing their forms without altering their values.

A fraction is in its *lowest terms* when its numerator and denominator are prime to each other, as $\frac{1}{2}$, $\frac{3}{4}$, but not $\frac{2}{4}$.

Since the numerator and denominator of a fraction are a dividend and a divisor, they may be divided by the same number without changing the quotient, or value of the fraction.

CASE I.

To reduce a fraction to its lowest terms.

RULE.—Divide both terms by any common factor, and continue the process till the resulting terms are prime to each other. Or, divide both terms by their greatest common divisor.

EXAMPLE.—Reduce $\frac{8}{12}$ to its lowest terms.

$2 \cancel{4} \cancel{4} = \frac{1}{3}$, and $4 \cancel{3} \cancel{3} = \frac{1}{3}$ Ans. Or, $8 \cancel{4} \cancel{3} = \frac{1}{3}$ Ans.

Divide both terms by 2, which is a common factor, then the resulting terms by any common factor of them, say 4, which makes a fraction, $\frac{1}{3}$, the terms of which are prime to each other. $\frac{1}{3}$ is the fraction, $\frac{1}{3}$, in its lowest terms.

EXERCISES.

Reduce the following fractions to their lowest terms:—

- | | | | |
|---------------------|----------------------|------------------------|-----------------------|
| 1. $\frac{12}{18}$ | 6. $\frac{200}{300}$ | 11. $\frac{333}{444}$ | 16. $\frac{555}{666}$ |
| 2. $\frac{10}{15}$ | 7. $\frac{100}{150}$ | 12. $\frac{888}{1111}$ | 17. $\frac{720}{900}$ |
| 3. $\frac{24}{36}$ | 8. $\frac{111}{133}$ | 13. $\frac{177}{222}$ | 18. $\frac{160}{200}$ |
| 4. $\frac{33}{44}$ | 9. $\frac{188}{235}$ | 14. $\frac{444}{555}$ | 19. $\frac{333}{444}$ |
| 5. $\frac{77}{111}$ | 10. $\frac{77}{111}$ | 15. $\frac{555}{666}$ | 20. $\frac{666}{777}$ |

CASE II.

To reduce an improper fraction to a whole or mixed number.

RULE.—Divide the numerator by the denominator; the quotient will be the whole or mixed number.

NOTE.—If there be a fraction in the answer, reduce it to its lowest terms.

EXAMPLE.—Reduce $\frac{127}{16}$ to a whole or mixed number.

The denominator shows that the unit is divided into 16 equal parts; hence 16 sixteenths make 1, and there are as many units in $\frac{127}{16}$ as 16 is contained times in 87, and

$$\begin{array}{r} 16 \overline{) 87} (5 \frac{7}{16} \\ \underline{80} \\ 7 \end{array}$$

EXERCISES.

Reduce the following improper fractions to whole or mixed numbers:—

1. $\frac{441}{16}$

2. $\frac{781}{11}$

3. $\frac{29}{7}$

4. $\frac{37}{4}$

5. $\frac{174}{9}$

6. $\frac{42}{5}$

7. $\frac{1332}{11}$

8. $\frac{131}{8}$

9. $\frac{120}{21}$

10. $\frac{284}{82}$

11. $\frac{19876}{8879}$

12. $\frac{580}{18}$

CASE III.

To reduce a mixed number to an improper fraction.

RULE.—Multiply the whole number by the denominator of the fraction, to the product add the numerator, and write the denominator under the sum.

A whole number may be expressed fractionally by writing 1 under it for a denominator.

A whole number may be reduced to a fraction having any proposed denominator, by multiplying it by the proposed denominator for a numerator and writing the proposed denominator under the product.

EXAMPLE.—Reduce $4\frac{1}{2}$ to an improper fraction.

$4\frac{1}{2}$ The denominator of the given fraction is to become the denominator of the answer, therefore, the answer is to be halves, and as two halves make a unit, there will be twice as many halves as units, that is, twice 4, and the 1 half expressed by the fraction added makes 9 halves, or $\frac{9}{2}$.

EXERCISES.

1. Reduce $4\frac{3}{4}$ to an improper fraction.
2. Reduce $27\frac{1}{2}$ to an improper fraction.
3. Reduce $66\frac{1}{3}$ to an improper fraction.
4. Reduce $18\frac{5}{8}$ to an improper fraction.
5. How many sevenths in $9\frac{1}{4}$?
6. In $\$7\frac{5}{8}$ how many eights of a dollar?
7. In $17\frac{2}{3}$ gallons how many thirds of a gallon.
8. Change 27 to a fraction.
9. Express 9 as a fraction having 7 for its denominator.
10. Reduce 19 to twelfths.
11. Reduce 28 to a fraction having 19 for its denominator.

MULTIPLICATION OF FRACTIONS.

Multiplication of Fractions is the process of multiplication when one or both of the factors are fractional.

CASE I.

To multiply a fraction by a whole number.

RULE.—Multiply the numerator of the given fraction by the given whole number, and set the product over the denominator. Or, when it can be done without a remainder,

Divide the denominator by the whole number, and set the quotient under the numerator.

NOTE.—Resulting fractions are, in all cases, if improper, to be reduced to whole or mixed numbers; if proper, to their lowest terms.

EXAMPLE.—Multiply $\frac{2}{3}$ by 8.

$$\frac{2}{3} \times 8 = \frac{16}{3} = 5\frac{1}{3}.$$

EXERCISES.

Multiply,

- | | | |
|-------------------------|--------------------------|-------------------------|
| 1. $\frac{2}{3}$ by 3. | 4. $\frac{1}{16}$ by 8. | 7. $\frac{1}{11}$ by 3. |
| 2. $\frac{1}{4}$ by 8. | 5. $\frac{1}{16}$ by 5. | 8. $\frac{1}{11}$ by 7. |
| 3. $\frac{1}{11}$ by 9. | 6. $\frac{1}{11}$ by 17. | 9. $\frac{1}{11}$ by 6. |

CASE II.

To multiply a whole number by a fraction.

RULE.—Multiply the given whole number by the numerator of the given fraction, and set the product over the denominator.

EXAMPLE.—Multiply 8 by $\frac{2}{3}$.

$$8 \times \frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}.$$

EXERCISES.

Multiply,

- | | | |
|--------------------------|-----------------------------|-----------------------------|
| 1. 7 by $\frac{2}{3}$. | 4. 5 by $\frac{7}{10}$. | 7. 468 by $\frac{2}{3}$. |
| 2. 12 by $\frac{5}{8}$. | 5. 4783 by $\frac{1}{12}$. | 8. 5781 by $\frac{7}{13}$. |
| 3. 18 by $\frac{4}{5}$. | 6. 39 by $\frac{1}{13}$. | 9. 78 by $\frac{1}{12}$. |

CASE III.

To multiply one fraction by another, or several fractions together.

RULE.—Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

NOTE.—When some of the factors are mixed numbers, they must be reduced to simple fractions.

EXAMPLE.—Multiply $\frac{3}{8}$ by $\frac{5}{7}$.

1st, Multiply $\frac{3}{8}$ by 5 = $\frac{15}{8}$; but as 5 is 7 times the multiplier, $\frac{5}{7}$, the product, $\frac{15}{8}$, is 7 times the required product; in other words, the required product must be $\frac{1}{7}$ as much as $\frac{15}{8}$. Now, if $\frac{15}{8}$ be divided into 7 equal parts, each of the parts will be $\frac{1}{56}$, or $\frac{1}{7}$ as much as $\frac{1}{8}$; therefore, $\frac{1}{7}$ as much as $\frac{15}{8}$ is $\frac{15}{56}$, which is what is required. Therefore, 2nd, multiply the denominator, 8, by the denominator, 7, for the denominator of the product.

EXERCISES.

1. Multiply $\frac{2}{3}$ by $\frac{3}{4}$.
2. Multiply $\frac{3}{4}$ by $\frac{4}{5}$.
3. Multiply $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{4}{5}$ together.
4. Multiply $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$ and $\frac{5}{6}$ together.

Observe the following methods of doing the last exercise.

1ST METHOD.

$\frac{4}{5} \times \frac{5}{8} \times \frac{7}{9} \times \frac{3}{7} = \frac{4 \times 5 \times 7 \times 3}{5 \times 8 \times 9 \times 7} = \frac{1}{6}$.
by reducing the fraction $\frac{4 \times 5 \times 7 \times 3}{5 \times 8 \times 9 \times 7}$
by the greatest common divi-
sor of its terms, viz: 420.

2ND METHOD.

$$\frac{4}{\cancel{5}} \times \frac{\cancel{5}}{8} \times \frac{7}{\cancel{9}} \times \frac{\cancel{3}}{7} = \frac{1}{6}.$$

1st. Divide the numerator, 4, and the denominator, 8, by 4, which will divide both exactly; next cancel the numerator, 5, and the denominator, 5; next cancel the two 7's; lastly divide the numerator, 3, and the denominator, 9, by 3. Then multiply the quotients instead of the original numbers.

The second method is called

CANCELLING,

and depends upon the principle already stated,—that if the numerator and denominator of a fraction, and therefore of the factors which make up a fraction, be divided by the same number, the value of the fraction will not be changed.

RULE.—Divide any numerator and any denominator of the fractions to be multiplied by any number that will divide both without a remainder, and continue the process until no numerator and denominator can be exactly divided by any number greater than 1. Or, cancel equal factors in numerators and denominators. Multiply the resulting figures, and the product will be obtained in its lowest terms.

NOTE.—When a quotient is 1, it may be omitted.

5. Multiply $\frac{4}{5}$, $\frac{7}{8}$, $\frac{3}{9}$ and $\frac{3}{7}$ together.
6. Multiply $\frac{10}{18}$, $3\frac{1}{2}$, $2\frac{1}{2}$ and $\frac{4}{7}$ together.
7. Multiply $5\frac{5}{8}$, $4\frac{1}{4}$ and $1\frac{1}{8}$ together.
8. Multiply $3\frac{3}{4}$, $1\frac{1}{8}$, $1\frac{1}{4}$ and $6\frac{1}{2}$ together.

A **Compound Fraction** is essentially an expression of multiplication of fractions. Thus, $\frac{2}{3}$ of $\frac{3}{4}$ is equivalent to $\frac{2}{3} \times \frac{3}{4}$. The latter expression indicates that $\frac{3}{4}$ is to be repeated as often as there are units in $\frac{2}{3}$. Now, $\frac{2}{3}$ does not contain a unit, but only two-thirds of a unit; therefore, $\frac{3}{4}$ is to be taken two-thirds of once, which will be equal to $\frac{2}{3}$ of itself, or $\frac{2}{3}$ of $\frac{3}{4}$. Therefore,

To reduce a compound fraction to a simple fraction.

RULE.—*Multiply all the numerators for a new numerator, and all the denominators for a new denominator, cancelling as before, whenever practicable.*

9. Reduce $\frac{5}{8}$ of $1\frac{1}{2}$ to a simple fraction.
10. Reduce $\frac{1}{10}$ of $4\frac{1}{2}$ of $\frac{1}{10}$ to a simple fraction.
11. What is the value of $\frac{5}{8}$ of $\frac{1}{2}$ of $1\frac{1}{2}$ of $\frac{1}{8}$?
12. What is the value of $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{3}{8}$ of $1\frac{1}{2}$?
13. What is the value of $\frac{1}{4}$ of $5\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{11}$ of 4?
14. What is the cost of $\frac{2}{3}$ of $\frac{1}{4}$ of a pound of tea at $\frac{1}{2}$ of a dollar per pound?
15. Multiply $\frac{3}{4}$ of $1\frac{1}{2}$ by $\frac{1}{10}$ of $2\frac{1}{2}$.
16. Multiply $\frac{2}{3}$, $1\frac{1}{2}$, $\frac{1}{4}$ and $2\frac{1}{3}$ together.
17. What is the product of $1\frac{1}{2}$ of $\frac{1}{8}$ of 4 by $\frac{3}{8}$ of $3\frac{1}{2}$?

CASE IV.

To multiply a whole number by a mixed number.

RULE.—*Multiply by the fractional part and the whole number separately, and add the products.*

NOTE.—It will be found more convenient to multiply by the fraction first.

EXAMPLE.—Multiply 320 by $8\frac{1}{2}$.

$$\begin{array}{r}
 2)320 \\
 \underline{8\frac{1}{2}} \\
 160 \\
 2560 \\
 \hline
 2720 \text{ Ans.}
 \end{array}$$

EXERCISES.

Multiply,

- | | |
|-----------------------------|-----------------------------|
| 1. 4629 by $5\frac{1}{2}$. | 3. 4763 by $7\frac{1}{2}$. |
| 2. 198 by $6\frac{1}{2}$. | 4. 1875 by $8\frac{1}{2}$. |

DIVISION OF FRACTIONS.

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$$\begin{array}{r} 1875 \\ 8\frac{3}{4} \\ \hline 4 \overline{)5625} = \text{product by } 3 \\ 1406\frac{1}{4} = \text{ " } \frac{3}{4} \\ 15000 = \text{ " } 8 \\ \hline 16406\frac{1}{4} = \text{ " } 8\frac{3}{4} \end{array}$$

Or,

$$\begin{array}{r} 2 \overline{)1875} \\ 8\frac{3}{4} \\ \hline 937\frac{1}{2} = \text{product by } \frac{1}{4} \\ 468\frac{3}{4} = \text{ " } \frac{1}{4} \\ 15000 = \text{ " } 8 \\ \hline 16406\frac{1}{4} = \text{ " } 8\frac{3}{4} \end{array}$$

5. 6428 by $9\frac{3}{4}$.
6. 5630 by $23\frac{5}{8}$.
7. 2769 by $14\frac{3}{8}$.
8. 764 by $105\frac{7}{8}$.
9. 785 by $63\frac{1}{4}$.

10. 215 by $73\frac{1}{4}$.
11. 612 by $87\frac{1}{2}$.
12. 652 by $92\frac{5}{8}$.
13. 739 by $75\frac{3}{4}$.
14. 575 by $84\frac{3}{8}$.

NOTE.—Observe that where the whole number and the numerator of the fraction are the same, you need only multiply once, thus,

15. Multiply 7960 by $3\frac{3}{4}$.

$$\begin{array}{r} 7960 \\ 3\frac{3}{4} \\ \hline 4 \overline{)23880} \\ 5970 \\ \hline 29850 \text{ Ans.} \end{array}$$

16. If a ton of hay cost \$17.60, what is the price of $3\frac{3}{4}$ tons?
17. What is the price of $14\frac{7}{8}$ barrels of apples at \$5.50 per barrel?
18. Find the value of $324\frac{1}{2}$ acres of land at \$35.85 per acre.
19. What will $4\frac{1}{2}$ bushels of wheat cost at \$1.75 per bushel?
20. Multiply 7598 by $2\frac{3}{4}$; by $3\frac{3}{8}$; by $4\frac{1}{4}$; by $7\frac{1}{4}$.

DIVISION OF FRACTIONS.

Division of Fractions is the process of division when the divisor or dividend or both are fractional.

CASE I.

To divide a fraction by a whole number.

RULE.—Divide the numerator by the whole number, if it can be done without a remainder, and set the quotient over the denominator. Or, multiply the denominator by the whole number, and set the numerator over the product.

EXERCISES.

EXAMPLE.—Divide $\frac{1}{2}$ by 2.

$$\frac{1}{2} \div 2 = \frac{1}{4} \text{ Ans.} \quad \text{Or,} \quad \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} = \frac{1}{4} \text{ Ans.}$$

To divide any quantity by 2 gives the half of that quantity; and as the half of $\frac{1}{2}$ is $\frac{1}{4}$, the correctness of the first method is evident.

The second method may be explained thus: $\frac{1}{2}$ indicates that the unit is divided into five equal parts, of which 4 are expressed. If the denominator 5 be multiplied by 2, the fraction will be expressed in tenths, and shows that the unit is divided into twice as many parts as before, and the parts are therefore only half the value of fifths; if then the same number of parts be taken, the fraction ($\frac{4}{10}$) will represent half of $\frac{1}{2}$, which was required, and the principle holds good in all cases.

Divide,

- | | | |
|-------------------------|-------------------------|---------------------------|
| 1. $\frac{1}{2}$ by 5. | 6. $\frac{1}{12}$ by 4. | 11. $\frac{1}{11}$ by 4. |
| 2. $\frac{1}{7}$ by 4. | 7. $\frac{1}{3}$ by 6. | 12. $\frac{2}{5}$ by 5. |
| 3. $\frac{1}{8}$ by 7. | 8. $\frac{1}{7}$ by 4. | 13. $\frac{1}{3}$ by 12. |
| 4. $\frac{1}{3}$ by 9. | 9. $\frac{1}{5}$ by 11. | 14. $\frac{2}{3}$ by 15. |
| 5. $\frac{2}{7}$ by 12. | 10. $\frac{1}{6}$ by 3. | 15. $16\frac{2}{3}$ by 5. |

CASE II.

To divide a whole number by a fraction.

RULE.—Divide the whole number by the numerator of the fraction, if it can be done without a remainder, and multiply the quotient by the denominator. Or, multiply the whole number by the denominator, and divide the product by the numerator.

EXAMPLE.—Divide 8 by $\frac{2}{3}$.

$$8 \div 2 = 4, \text{ and } 4 \times 3 = 12 \text{ Ans.} \quad \text{Or,} \quad 8 \times \frac{3}{2} = 12 = 12 \text{ Ans.}$$

EXERCISES.

Divide,

- | | | |
|--------------------------|--------------------------|----------------------------|
| 1. 1 by $\frac{1}{2}$. | 5. 28 by $\frac{1}{2}$. | 9. 33 by $\frac{1}{2}$. |
| 2. 16 by $\frac{1}{2}$. | 6. 49 by $\frac{1}{2}$. | 10. 516 by $\frac{1}{2}$. |
| 3. 9 by $\frac{1}{2}$. | 7. 78 by $\frac{1}{2}$. | 11. 63 by $\frac{1}{2}$. |
| 4. 18 by $\frac{1}{2}$. | 8. 88 by $\frac{1}{2}$. | 12. 81 by $\frac{1}{2}$. |

CASE III.

To divide one fraction by another.

RULE.—*Invert the divisor and proceed as in multiplication.*

NOTE 1.—If the divisor or dividend or both be mixed numbers they must be reduced to improper fractions.

NOTE 2.—The rule for this case will solve any case in division of fractions; but the operations are sometimes more tedious than by the rules laid down for other cases.

EXAMPLE.—Divide $\frac{7}{8}$ by $\frac{3}{4}$.

$$\frac{7}{8} \times \frac{4}{3} = \frac{7}{6} = 1\frac{1}{6} \text{ Ans.}$$

This operation may be explained by reference to the preceding rules. thus: 1st, divide $\frac{7}{8}$ by 3, that is, (Case i.) multiply the denominator by 3; now we have divided by a number 4 times the given divisor, hence the quotient $\frac{7}{24}$ is only $\frac{1}{4}$ of what is required, therefore, next, multiply by 4 which gives $\frac{7}{6} = 1\frac{1}{6}$, Ans. By cancelling as above the work is shortened.

EXERCISES.

Divide,

- | | | |
|---------------------------------------|--|--|
| 1. $\frac{5}{8}$ by $\frac{7}{12}$. | 8. $\frac{4}{18}$ by $4\frac{1}{2}$. | 15. $18\frac{7}{8}$ by $9\frac{1}{2}$. |
| 2. $1\frac{1}{4}$ by $1\frac{1}{8}$. | 9. $5\frac{1}{2}$ by $4\frac{1}{2}$. | 16. $10\frac{1}{2}$ by $5\frac{3}{4}$. |
| 3. $\frac{2}{3}$ by $\frac{3}{4}$. | 10. $4\frac{1}{2}$ by $5\frac{1}{2}$. | 17. $9\frac{1}{2}$ by $8\frac{1}{2}$. |
| 4. $1\frac{1}{8}$ by $\frac{3}{4}$. | 11. $8\frac{1}{2}$ by $3\frac{1}{2}$. | 18. $3\frac{1}{2}$ by $8\frac{3}{4}$. |
| 5. $4\frac{1}{2}$ by $\frac{4}{5}$. | 12. $6\frac{3}{4}$ by $3\frac{1}{2}$. | 19. $3\frac{3}{4}$ by $5\frac{1}{16}$. |
| 6. $9\frac{3}{8}$ by $\frac{3}{8}$. | 13. $4\frac{5}{8}$ by $3\frac{3}{8}$. | 20. $16\frac{7}{8}$ by $31\frac{1}{2}$. |
| 7. $\frac{3}{4}$ by $1\frac{1}{2}$. | 14. $7\frac{1}{2}$ by $5\frac{1}{2}$. | 21. $12\frac{3}{8}$ by $18\frac{3}{8}$. |

When it is required to divide the product of several fractions by the product of several others.

RULE.—*Invert all the factors of the divisor and multiply all together.*

22. Divide the product of $\frac{3}{4}$, $\frac{4}{5}$ and $\frac{5}{6}$ by the product of $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{2}{3}$.

$$\frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{2}{1} \times \frac{4}{3} \times \frac{11}{8} = \frac{11}{2} = 5\frac{1}{2} \text{ Ans.}$$

23. Divide the product of $\frac{5}{8}$, $4\frac{1}{2}$ and $\frac{4}{5}$ by the product of $\frac{7}{8}$, $1\frac{1}{2}$, $3\frac{1}{2}$ and $\frac{4}{5}$.

Divide,

24. $\frac{2}{3}$ of $2\frac{2}{3}$ by $\frac{1}{4}$ of $4\frac{1}{2}$.
25. $\frac{3}{8}$ of $\frac{7}{8}$ by $\frac{1}{4}$ of $1\frac{1}{2}$.
26. $\frac{1}{3}$ of $\frac{9}{16}$ of $\frac{7}{16}$ by $\frac{2}{3}$ of $1\frac{1}{2}$ of $\frac{1}{2}$.
27. $\frac{3}{8}$ of $\frac{1}{4}$ of $\frac{1}{4}$ by $\frac{1}{8}$ of $\frac{3}{4}$ of $\frac{1}{4}$.
28. $\frac{1}{3}$ of $5\frac{1}{2}$ of 7 by $\frac{1}{8}$ of $3\frac{1}{16}$.
29. $\frac{7}{18}$ of $\frac{2}{11}$ of $6\frac{1}{2}$ of 12 by $\frac{1}{8}$ of $4\frac{1}{2}$.

A **Complex Fraction** is an expression of division of fractions,—the denominator being the divisor, and the numerator the dividend. Hence,

To reduce a complex fraction to a simple fraction.

RULE.—Divide the numerator by the denominator.

EXAMPLE.—Find the value of $\frac{\frac{3}{4}}{\frac{5}{8}}$.

$$\frac{3}{4} \times \frac{8}{5} = \frac{5}{4} = 1\frac{1}{4}.$$

30. What is the value of $\frac{\frac{5}{8}}{\frac{3}{11}}$?
31. Reduce $\frac{7}{4}$ to a simple fraction.
32. Find the value of $\frac{7}{1\frac{1}{4}}$.
33. Reduce $\frac{7}{3\frac{1}{2}}$ to a simple fraction.
34. Find the value of $\frac{7\frac{1}{2}}{1\frac{1}{8}}$.
35. Reduce $\frac{9\frac{3}{4}}{12\frac{3}{4}}$ to a simple fraction.
36. Divide $\frac{1}{3}$ of $\frac{11}{24}$ of $5\frac{1}{2}$ by $\frac{3\frac{1}{2}}{6\frac{1}{2}}$ of $\frac{7}{8}$ of 13.

CASE IV.

To divide a mixed number by a whole number, when the dividend is greater than the divisor.

RULE.—Divide the integral part of the dividend by the divisor. The remainder with the fraction, or the fraction alone, if there be no remainder, will form the numerator of a complex fraction of which the divisor is the denominator. Reduce this complex fraction to a simple one, and annex it to the quotient.

DIVISION OF FRACTIONS.

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EXAMPLE.—Divide $5876\frac{2}{3}$ by 3.

$$\begin{array}{r} 3 \overline{) 5876\frac{2}{3}} \\ \underline{1958\frac{2}{3}} \text{ Ans.} \end{array}$$

The remainder $2\frac{2}{3} \div$ the divisor, $3 = \frac{2\frac{2}{3}}{3} = \frac{2}{3}$, which completes the quotient.

EXERCISES.

Divide,

- | | |
|------------------------------|------------------------------|
| 1. $7918\frac{4}{5}$ by 5. | 6. $5240\frac{1}{2}$ by 48. |
| 2. $4918\frac{1}{2}$ by 9. | 7. $1288\frac{7}{8}$ by 28. |
| 3. $68355\frac{3}{4}$ by 7. | 8. $5784\frac{3}{4}$ by 8. |
| 4. $19864\frac{3}{4}$ by 27. | 9. $819\frac{1}{2}$ by 12. |
| 5. $913\frac{1}{2}$ by 51. | 10. $1641\frac{1}{2}$ by 20. |

CASE V.

To divide a whole or mixed number by a mixed number, when the dividend is greater than the divisor.

RULE.—Multiply both the divisor and the dividend by the denominator of the fraction in the divisor, and proceed by the last rule.

EXAMPLE.—Divide 372 by $4\frac{1}{2}$.

$$\begin{array}{r} 4\frac{1}{2} \overline{) 372} \\ \underline{2} \\ 9 \overline{) 744} \\ \underline{82\frac{2}{3}} \text{ Ans.} \end{array}$$

EXERCISES.

Divide,

- | | |
|--|--|
| 1. $5973\frac{3}{4}$ by $8\frac{1}{2}$. | 6. $583\frac{1}{2}$ by $43\frac{3}{4}$. |
| 2. $386\frac{3}{4}$ by $5\frac{3}{4}$. | 7. $848\frac{1}{2}$ by $13\frac{1}{2}$. |
| 3. 5987 by $3\frac{1}{2}$. | 8. $1429\frac{1}{2}$ by $8\frac{1}{2}$. |
| 4. 9176 by $5\frac{1}{2}$. | 9. $429\frac{1}{2}$ by $16\frac{1}{2}$. |
| 5. $763\frac{3}{4}$ by $2\frac{3}{4}$. | 10. $7057\frac{1}{2}$ by $14\frac{1}{2}$. |

NOTE.—The problems in the last two cases, as well as all others in division of fractions, may be solved by the general rule under Case iii. The methods here given are deductions from that rule; and when the dividend is a large number they are very convenient, and those generally adopted.

LEAST COMMON DENOMINATOR.

It has already been shown that to divide both terms of a fraction by the same number does not change the value of the fraction. Hence, also,

To multiply both terms of a fraction by the same number does not change the value of the fraction.

Two or more fractions have a common denominator when their denominators are alike. Thus, $\frac{2}{7}$, $\frac{3}{7}$ and $\frac{4}{7}$ have a common denominator, 7.

Any two or more fractions may be reduced to equivalent fractions, having a common denominator.

A common denominator of two or more fractions must be a common multiple of their denominators, in order that the equivalent fractions having the common denominator shall be simple fractions.

Thus a common denominator for the fractions $\frac{2}{3}$ and $\frac{3}{4}$ must be a common multiple of 3 and 4, as 12, 24, 36, &c., and $\frac{2}{3}$ and $\frac{3}{4}$ may be reduced to equivalent fractions having 12, 24, 36 or any other common multiple of 3 and 4 for their common denominator.

The **Least Common Denominator** of two or more fractions is the **Least Common Multiple** of their denominators.

To reduce two or more fractions to equivalent fractions having a common denominator.

RULE.—*Multiply both terms of each fraction by the product of all the denominators except its own.*

EXAMPLE.—Reduce $\frac{2}{3}$ and $\frac{3}{4}$ to equivalent fractions having a common denominator.

$$2 \times 4 = 8$$

$$3 \times 4 = 12$$

$$3 \times 3 = 9$$

$$4 \times 3 = 12$$

Take 12 for a common denominator. Then, since the numerator and denominator of a fraction may be multiplied by the same number without altering its value, multiply both terms of $\frac{2}{3}$ by 4, because it makes the denominator 12; and multiply both terms of $\frac{3}{4}$ by 3, for a like reason; and we obtain $\frac{8}{12}$ and $\frac{9}{12}$ as equivalent fractions having a common denominator.

1. Reduce $\frac{5}{8}$, $\frac{3}{8}$ and $\frac{2}{3}$ to equivalent fractions having a common denominator.

$$\begin{array}{rcl} 5 \times 6 \times 3 & = & 120 \\ 3 \times 6 \times 3 & = & 54 \\ 2 \times 6 \times 8 & = & 96 \\ \hline 6 \times 8 \times 3 & = & 144 \end{array} \quad \begin{array}{l} \frac{1}{2} = \frac{72}{144} \\ \frac{1}{3} = \frac{48}{144} \\ \frac{1}{4} = \frac{36}{144} \end{array}$$

2. Reduce $\frac{1}{2}$, $4\frac{1}{2}$ and $\frac{5}{8}$ to equivalent fractions having a common denominator.

To reduce two or more fractions to equivalent fractions having the least common denominator.

RULE.—Find the least common multiple of the denominators which will be the least common denominator.

For the numerators, divide the least common denominator by the denominator of each fraction, and multiply the quotient by the corresponding numerator.

NOTE.—If the fractions are not all simple, they must be reduced to simple fractions, and to their lowest terms.

EXAMPLE.—Reduce $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ to their equivalents with their least common denominator.

The least common denominator is 30. Then,

$$\begin{array}{rcl} 2 \overline{)30} & 3 \overline{)30} & 4 \overline{)30} \\ \frac{15}{15} & \frac{10}{10} & \frac{7\frac{1}{2}}{10} \end{array} \quad \text{that is,} \quad \begin{array}{l} \frac{1}{2} = \frac{15}{30} \\ \frac{2}{3} = \frac{20}{30} \\ \frac{3}{4} = \frac{22\frac{1}{2}}{30} \end{array}$$

The process is equal to the following:

$$\begin{array}{l} 1 \times 15 = 15 \quad 2 \times 10 = 20 \quad 3 \times 6 = 18 \\ 2 \times 15 = 30 \quad 3 \times 10 = 30 \quad 5 \times 6 = 30 \end{array}$$

and the multiplier for each fraction is found by dividing the least common denominator by the denominator of the fraction.

EXERCISES.

Reduce the following fractions to equivalent fractions having their least common denominators:

1. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$.
2. $\frac{1}{2}$, $\frac{3}{8}$, $\frac{1}{12}$.
3. $\frac{1}{4}$, $\frac{1}{6}$, $\frac{2}{10}$, $\frac{1}{15}$.
4. $\frac{1}{2}$, $\frac{1}{12}$, $5\frac{1}{6}$.
5. $\frac{1}{4}$, $2\frac{3}{8}$, $\frac{1}{12}$, $\frac{2\frac{1}{2}}{8\frac{2}{11}}$.
6. $1\frac{1}{2}$, $1\frac{1}{12}$, $7\frac{1}{3}$, $7\frac{1}{24}$.
7. $\frac{1}{2}$, $\frac{1}{3}$ of $3\frac{1}{2}$ and $\frac{2}{3}$ of $\frac{3}{4}$.
8. $\frac{2}{3}$ of $\frac{3}{4}$, $\frac{1}{4}$ of $\frac{2}{3}$, $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{3}{4}$ of $2\frac{1}{2}$.
9. $\frac{1}{2}$ of $\frac{3}{4}$, $\frac{1}{3}$ of $4\frac{1}{2}$, $\frac{2}{9}$.
10. $5\frac{1}{2}$, $\frac{2}{3}$ of $1\frac{1}{2}$, $\frac{6\frac{3}{4}}{4\frac{1}{11}}$.

ADDITION OF FRACTIONS.

Addition of Fractions is the process of finding the sum of several fractions.

To add fractions.

RULE.—If the fractions to be added have the same denominator, add their numerators, and write the sum over the common denominator. If the fractions have not the same denominator, reduce them to a common denominator; add the new numerators, and set the sum over the common denominator.

EXERCISES

Add the following fractions:

1. $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{5}$ and $\frac{1}{6}$.
2. $\frac{1}{11}$, $\frac{1}{11}$, $\frac{1}{11}$, $\frac{1}{11}$ and $\frac{2}{11}$.
3. $\frac{17}{24}$, $\frac{25}{24}$, $\frac{43}{24}$ and $\frac{25}{24}$.
4. $\frac{2}{3}$ and $\frac{1}{4}$.
5. $\frac{1}{2}$ and $\frac{3}{4}$.
6. $\frac{2}{3}$ and $\frac{1}{4}$.
7. $\frac{1}{2}$ and $\frac{1}{3}$.
8. $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{1}{3}$.
9. $\frac{2}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$.
10. $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{1}{6}$.

$$\frac{2}{3} \times \frac{4}{4} = \frac{8}{12}, \text{ and } \frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1 \frac{8}{12}.$$

When there are mixed numbers it is as well to add the fractions and whole numbers separately, and add their sums.

11. $1\frac{1}{2}$ and $2\frac{2}{3}$.

$$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}, \text{ and } \frac{1}{3} + \frac{2}{3} = \frac{3}{3} = 1 \frac{3}{6}.$$

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4},$$

$$\text{Then, } 1 + 2 = 3$$

$$\frac{4}{4} \text{ Ans.}$$

12. $2\frac{1}{2}$ and $3\frac{1}{2}$.
13. $2\frac{1}{4}$, $3\frac{1}{4}$ and $4\frac{1}{4}$.
14. $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$ and $4\frac{1}{2}$.
15. $16\frac{2}{3}$, $12\frac{2}{3}$, $8\frac{2}{3}$ and $2\frac{1}{3}$.
16. $\frac{2}{3}$, $4\frac{1}{2}$, $\frac{7}{12}$, $9\frac{1}{4}$ and $5\frac{3}{8}$.
17. $\frac{2}{3}$ of $\frac{1}{2}$ and $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{2}$.
18. $\frac{1}{3}$ of $6\frac{2}{3}$ and $\frac{1}{15}$ of $\frac{2}{3}$ of $7\frac{1}{2}$.
19. $\frac{1}{4}$ of $96\frac{1}{4}$ and $\frac{1}{5}$ of $\frac{1}{2}$ of $5\frac{1}{2}$.
20. $\frac{17}{25}$, $7\frac{3}{10}$, $\frac{2}{5}$ of $4\frac{1}{2}$ and $\frac{5}{8}\frac{7}{15}$.

The following will be found useful:

To add two fractions each of which has 1 for a numerator.

RULE.—Add the denominators for a numerator, and multiply them for a denominator.

EXERCISES.

Add the following fractions:

- | | | |
|--------------------------------------|--------------------------------------|---------------------------------------|
| 1. $\frac{1}{2}$ and $\frac{1}{2}$. | 5. $\frac{1}{2}$ and $\frac{1}{2}$. | 9. $\frac{1}{2}$ and $\frac{1}{2}$. |
| 2. $\frac{1}{2}$ and $\frac{1}{2}$. | 6. $\frac{1}{2}$ and $\frac{1}{2}$. | 10. $\frac{1}{2}$ and $\frac{1}{2}$. |
| 3. $\frac{1}{2}$ and $\frac{1}{2}$. | 7. $\frac{1}{2}$ and $\frac{1}{2}$. | 11. $\frac{1}{2}$ and $\frac{1}{2}$. |
| 4. $\frac{1}{2}$ and $\frac{1}{2}$. | 8. $\frac{1}{2}$ and $\frac{1}{2}$. | 12. $\frac{1}{2}$ and $\frac{1}{2}$. |

SUBTRACTION OF FRACTIONS.

Subtraction of Fractions is the process of finding the difference between two fractions.

RULE.—If the fractions have the same denominator, subtract the smaller numerator from the larger and set the remainder over the common denominator. If they have not the same denominator, reduce them to a common denominator, take the difference between the new numerators, and set it over the common denominator.

EXERCISES.

From,

1. $\frac{7}{11}$ take $\frac{4}{11}$.

$$\frac{7}{11} - \frac{4}{11} = \frac{3}{11} \text{ Ans.}$$

2. $\frac{1}{2}$ take $\frac{1}{2}$.

4. $\frac{3}{4}$ take $\frac{1}{4}$.

3. $\frac{9}{11}$ take $\frac{4}{11}$.

5. $\frac{3}{4}$ take $\frac{1}{4}$.

$$\frac{3}{4} \times \frac{7}{7} = \frac{21}{28} \text{ and } \frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2} \text{ Ans.}$$

6. $\frac{7}{8}$ take $\frac{3}{8}$.

9. $\frac{7}{8}$ take $\frac{3}{8}$.

7. $\frac{1}{2}$ take $\frac{1}{2}$.

10. $\frac{1}{2}$ take $\frac{1}{2}$.

8. $\frac{5}{8}$ take $\frac{3}{8}$.

11. $\frac{1}{2}$ take $\frac{1}{2}$.

When a mixed number occurs it may be reduced to an improper fraction, and the subtraction performed according to the rule.

Or, the fractions and whole numbers may be subtracted separately; but it must be observed to add 1 to the fraction in the minuend, if it be less than that in the subtrahend, and carry 1 to the unit's figure of the subtrahend.

12. From $4\frac{3}{4}$ take $2\frac{1}{4}$.

$$\begin{array}{r} 4\frac{3}{4} \\ 2\frac{1}{4} \\ \hline 2\frac{2}{4} \text{ Ans.} \end{array}$$

From,

- | | |
|--|--|
| 13. $5\frac{7}{8}$ take $3\frac{1}{4}$. | 17. $8\frac{1}{2}$ take $3\frac{3}{8}$. |
| 14. $18\frac{1}{2}$ take $12\frac{7}{8}$. | 18. $7\frac{3}{4}$ take $4\frac{1}{4}$. |
| 15. $963\frac{1}{2}$ take $437\frac{7}{8}$. | 19. $27\frac{1}{2}$ take $19\frac{1}{4}$. |
| 16. $3\frac{1}{2}$ take $1\frac{3}{4}$. | 20. 16 take $3\frac{1}{8}$. |

Here it is easier to subtract the fraction and whole numbers separately. Thus,

$$\begin{array}{r} 16 \\ 3\frac{1}{8} \\ \hline 12\frac{7}{8} \end{array} \quad \begin{array}{l} \text{Subtract } \frac{1}{8} \text{ from } 1 (\frac{8}{8}) \text{ and } \frac{7}{8} \text{ remain, carry 1 to } 3=4; \\ 4 \text{ from } 16=12. \end{array}$$

Ans.

21. From $391\frac{2}{3}$ take $147\frac{3}{4}$.

$$\begin{array}{r} 391\frac{2}{3} \\ 147\frac{3}{4} \\ \hline 243\frac{1}{2} \end{array} \quad \begin{array}{l} \text{Add 1 to } \frac{2}{3}=1\frac{2}{3}=\frac{4}{3}; \text{ then,} \\ \frac{4}{3} \times 4 = \frac{16}{3} \\ \frac{16}{3} \times \frac{2}{2} = \frac{32}{6}; \text{ and } \frac{32}{6} - \frac{9}{6} = \frac{23}{6}. \text{ Carry 1 to the} \\ \text{whole numbers.} \end{array}$$

From,

- | | |
|--|---|
| 22. $320\frac{1}{2}$ take $249\frac{1}{4}$. | 26. 480 take $127\frac{5}{8}$. |
| 23. $164\frac{5}{8}$ take $87\frac{7}{8}$. | 27. $364\frac{3}{8}$ take $96\frac{1}{4}$. |
| 24. $291\frac{7}{8}$ take $148\frac{7}{8}$. | 28. $75\frac{5}{8}$ take $57\frac{7}{8}$. |
| 25. $943\frac{1}{2}$ take $583\frac{7}{8}$. | 29. $185\frac{7}{8}$ take $91\frac{1}{2}$. |

30. A has \$725 $\frac{5}{8}$, and B has \$690 $\frac{3}{4}$, how much more has A than B?

31. A man owned $\frac{3}{8}$ of a ship, and sold $\frac{1}{4}$ of his share, how much had he left?

32. What is the difference between $\frac{3}{8}$ of $1\frac{1}{2}$ and $\frac{4\frac{1}{2}}{16}$?

33. After selling $\frac{1}{4}$ of $\frac{5}{8}$ + $\frac{1}{2}$ of $\frac{3}{4}$ of a farm, what part of it remained?

When the numerator of each fraction is 1,

The difference of the denominators will be the numerator, and their product the denominator, of the difference.

EXERCISES.

From,

- | | |
|---------------------------------------|--|
| 1. $\frac{1}{2}$ take $\frac{1}{3}$. | 4. $\frac{1}{2}$ take $\frac{1}{8}$. |
| 2. $\frac{1}{2}$ take $\frac{1}{4}$. | 5. $\frac{1}{8}$ take $\frac{1}{8}$. |
| 3. $\frac{1}{2}$ take $\frac{1}{5}$. | 6. $\frac{1}{8}$ take $\frac{1}{18}$. |

DECIMAL FRACTIONS.

A **Decimal Fraction** is one that has 10, or some power of 10 for its denominator, as $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, &c.

The word decimal is derived from the Latin, *deccm*, ten.

Observe the relation between the decimal fractions, $\frac{6}{10}$, $\frac{6}{100}$, $\frac{6}{1000}$, &c.

The first is six tenths, or $\frac{1}{10}$ of 6 units; the second, six hundredths, or $\frac{1}{100}$ of $\frac{6}{10}$; the third, six thousandths, or $\frac{1}{1000}$ of $\frac{6}{100}$, &c.

Hence, it is seen that these fractions bear the same relation to one another as exists between the same digits, adjacent to one another, in a whole number, and also that the first of the series bears the same relation to 6 units. If, therefore, the numerators of these fractions be arranged side by side, thus, 666, they form an extension of the Arabic system, and may be used alone, or annexed to whole numbers without their denominators. Decimals are generally so written, and are known by being preceded by a period (.) called the *decimal point*, or *separatrix*.

TABLE OF DECIMAL ORDERS.

		Tenths. Hundredths. Thousandths. Ten-thousandths. Hundred-thousandths. Millionths. Ten-millionths. Hundred-millionths. Billionths.
1st place	.5.....	read, 5 tenths.
2nd "	.04.....	" 4 hundredths.
3rd "	.006.....	" 6 thousandths.
4th "	.0007.....	" 7 ten-thousandths.
5th "	.00003....	" 3 hundred-thousandths.
6th "	.000002...	" 2 millionths.
7th "	.0000009..	" 9 ten-millionths.
8th "	.00000001.	" 1 hundred-millionths.
9th "	.000000008	" 8 billionths.

Sum—.546732918 " five hundred and forty-six million, seven hundred and thirty-two thousand, nine hundred and eighteen billionths.

And it will be found that if each of these decimals be expressed in the common fractional form, viz: $\frac{5}{10}$, $\frac{4}{100}$, $\frac{6}{1000}$, &c., and added together by the rule for adding common fractions, the sum will be

$$\frac{546732918}{1000000000}.$$

By examining the above table and what has been said, it will be seen that the value of a decimal figure depends on the place the figure occupies, and diminishes in a one tenth ratio for every place the figure is removed farther from the decimal point.

Hence, to place a cipher on the right of a decimal does not alter the value of the decimal, because the cipher is nothing in itself, and, so placed, does not change the place of the other figures. But a cipher placed on the left, between the decimal and the point, removes the figures one place to the right, and thus divides the value of the decimal by 10.

To read decimals expressed by figures.

RULE.—*Read the decimal as a whole number, and give it the name of the right hand figure.*

EXERCISES.

Read the following:

- | | | |
|------------|---------------|------------------|
| 1. .2. | 7. .8004. | 13. 48.7804. |
| 2. .04. | 8. .4010. | 14. 83.0084. |
| 3. .138. | 9. .21042. | 15. 121.18006. |
| 4. .4531. | 10. .000014. | 16. 345.000018. |
| 5. .0098. | 11. .1743196. | 17. 909.000999. |
| 6. .00006. | 12. .0008980. | 18. 1203.080764. |

To write decimals in figures.

RULE.—*Write the decimal figures as a whole number; then place the point so that the right hand figure shall have its expressed value, placing ciphers to the left of the significant figures if necessary.*

EXERCISES.

Write decimally the following quantities:

- Five tenths.
- Twenty-two hundredths.

3. Eighty-seven thousandths.
4. Fifty-six ten-thousandths.
5. Three hundred and four ten-thousandths.
6. Five thousand three hundred and forty-seven ten thousandths.
7. Eighty-eight millionths.
8. Eight hundred and eight, and eight thousand and eight millionths.
9. Ten thousand and fifty-seven hundred-thousandths.
10. One hundred and twenty-one, and one hundred and twenty-one thousand, one hundred and one millionths.
11. Seven thousand and seven ten-millionths.
12. Twelve thousand, and twelve thousand, one hundred and one ten millionths.
13. Six hundred thousand six hundred and seven millionths.
14. Twenty-seven thousand nine hundred and five, and forty thousand and four millionths.
15. Ninety-seven million, four hundred and fifty three thousand, one hundred and sixty-eight billionths.

A decimal is deduced from a common fraction by changing the unit of the fraction to tenths, hundredths, &c., and performing the division indicated. Thus, $\frac{1}{4}$ means $\frac{1}{4}$ of 1, or $\frac{1}{4}$ of 4 units; but 4 units equal 40 tenths, hence $\frac{1}{4}$ of 4 units = $\frac{1}{4}$ of 40 tenths, or $\frac{10}{10}$ tenths = 8 tenths, or .8. Again, $\frac{1}{8}$ of a unit = $\frac{10}{100}$ tenths = .1, and $\frac{1}{8}$ of a tenth over, that is $\frac{10}{800}$ hundredths = .0125, and adding these three parts together they make .875 as a decimal equivalent to $\frac{7}{8}$. Therefore,

To deduce a decimal from a common fraction.

RULE.—Annex ciphers to the numerator and divide by the denominator, placing the point in the quotient so as to make as many decimal figures as ciphers annexed to the numerator.

EXAMPLE.—Deduce an equivalent decimal from $\frac{1}{4}$.

$$\begin{array}{r} 4 \overline{)1.00} \\ \underline{.25} \text{ Ans.} \end{array}$$

Deduce equivalent decimals from the following common fractions:

EXERCISES.

- | | | | |
|--------------------|---------------------|----------------------|---|
| 1. $\frac{3}{8}$. | 4. $\frac{3}{8}$. | 7. $\frac{13}{32}$. | 10. $\frac{4}{7}$. |
| 2. $\frac{3}{4}$. | 5. $\frac{5}{8}$. | 8. $\frac{17}{32}$. | 11. $\frac{4}{9}$ of $\frac{1}{16}$. |
| 3. $\frac{1}{2}$. | 6. $\frac{7}{16}$. | 9. $\frac{23}{32}$. | 12. $\frac{\frac{1}{2}}{\frac{1}{3}}$. |

In deducing decimals from common fractions when any quotient figure or figures are found to continually repeat, as in exercises 10 and 11 above, the decimal is called an **Infinite or Circulating Decimal**.

The part of the decimal which repeats is called a **Repetend**.

A repetend of a single figure may be terminated at any point by making it the numerator of a common fraction, with 9 for denominator, and annexing the fraction to the preceding decimal figures, if any.

A repetend of more than one figure may be terminated at any point where the period ends by making the repeating figures the numerator of a common fraction, and as many 9's for denominator, and annexing the fraction to the preceding decimal figures, if any. Of course, in all cases the common fraction should be reduced to its lowest terms.

Thus, $\frac{1}{3}$ is equal to .8333, &c., in which the figure 3 is a repetend. This decimal is correctly expressed thus, $.8\dot{3}$, or $.83\frac{1}{3}$, or $.833\frac{1}{3}$, &c., that is the $\frac{1}{3}$ is $\frac{1}{3}$ reduced to its lowest terms.

Again, $\frac{1}{7}$ is equal to .714285 repeated *ad infinitum*, and is correctly expressed $\dot{7}1428\dot{5} = \frac{1}{7}$, or $.71428\dot{5}$, or $.71428571428\dot{5}$, &c.

A repetend of one figure is distinguished by a point placed above it, thus, $.8\dot{3}$.

A repetend of more than one figure is denoted by a point over both the first and the last figures, thus, $\dot{7}1428\dot{5}$.

Reduce to decimals the following :

- | | | |
|---------------------|----------------------|-----------------------|
| 13. $\frac{1}{3}$. | 16. $\frac{8}{9}$. | 19. $\frac{11}{12}$. |
| 14. $\frac{2}{3}$. | 17. $\frac{7}{11}$. | 20. $\frac{3}{4}$. |
| 15. $\frac{5}{6}$. | 18. $\frac{7}{12}$. | 21. $\frac{6}{13}$. |

To reduce a decimal to a common fraction.

RULE.—Write the decimal for a numerator, omitting the point and ciphers on the left; and for a denominator, 1 with as many ciphers annexed as there are figures in the decimal, and reduce the fraction to its lowest terms.

EXERCISES.

Reduce the following decimals to common fractions :

- | | | |
|-----------|------------|----------------|
| 1. .5. | 6. .125. | 11. .390625. |
| 2. .25. | 7. .3125. | 12. .003125. |
| 3. .75. | 8. 2.125. | 13. .15234375. |
| 4. .875. | 9. 16.002. | 14. .864. |
| 5. .0625. | 10. .0175. | 15. .08125. |

When the decimal is a repetend, make the decimal with the point omitted the numerator, and as many 9's as there are repeating figures for denominator, and reduce the fraction as before.

Reduce the following decimals to common fractions :

- | | | |
|-----------------|------------------------|----------------------------|
| 16. $\dot{3}$. | 18. .8888. | 20. $\dot{3}0769\dot{2}$. |
| 17. $\dot{8}$. | 19. $\dot{7}\dot{2}$. | 21. $\dot{8}5714\dot{2}$. |

When the decimal is composed of a finite part and a repetend, convert the repetend into a common fraction, and annex it to the finite part; under this write the denominator of the decimal, and reduce the complex fraction thus formed to a simple one.

EXAMPLE.—Reduce $.8\dot{3}$ to a common fraction.

$$.8\dot{3} = .8\frac{3}{10} = .8\frac{3}{10}, \text{ that is, } \frac{8\frac{3}{10}}{10} = 8\frac{3}{10} \div 10 = \frac{25}{3} \times \frac{1}{10} = \frac{5}{6}. \text{ Ans.}$$

Reduce the following decimals to common fractions :

- | | | |
|---------------------|----------------------|-----------------------|
| 22. .91 $\dot{6}$. | 24. .708 $\dot{3}$. | 26. .7854 $\dot{5}$. |
| 23. .58 $\dot{3}$. | 25. .02 $\dot{7}$. | 27. .7854 $\dot{5}$. |

The following rule deduced from the above will be found convenient in solving questions like the last six :

RULE.—Subtract the finite part of the decimal from the whole, use the remainder for a numerator, and for a denominator as many 9's as there are figures in the repetend, and as many ciphers annexed as there are figures in the finite part.

ADDITION AND SUBTRACTION OF DECIMALS.

As decimals are merely an extension of the common Arabic system, they are added and subtracted in the same manner as whole numbers; and it should be remembered that *figures of the same order must be placed under one another, that is tenths under tenths, hundredths under hundredths, &c.* In other words,

Arrange the quantities to be added or subtracted so that the decimal points shall stand in a vertical column, add or subtract as in whole numbers, and place the decimal point in the sum or difference directly under those in the numbers added or subtracted.

EXAMPLE.—Add together .575, .0456, .73, and .16425.

Observe that the decimal points are in a column, so that tenths are under tenths, hundredths under hundredths, &c. The column of tenths, with what is carried to it, amounts to 15 tenths = 1 unit and 5 tenths.

$$\begin{array}{r}
 .575 \\
 .0456 \\
 .73 \\
 .16425 \\
 \hline
 1.51485
 \end{array}$$

EXERCISES.

Add the following decimals :

1. 21.611, 6888.32, 3.4167.
2. 5.61, 636.1, 6516.14, 67.1234, 1233.
3. 14.034, 25, .0000625, .0034.
4. 16.75, .375, 5, 3.4375, .000875.
5. 173, 7000.0005, 1.7, 125.728, .0005.
6. .16, 39.5, .7283.
7. 700.83, 16.765, .72835, 81.9.
8. .142857, .0186, 920, .0139428571.
9. What is the sum of .76, .416, .45, .648, .23?
10. Reduce to decimals and find the sum of $2\frac{3}{4}$, $4\frac{7}{8}$ and $5\frac{1}{5}$.
12. Find the sum of .427, .416, 1.328, 3.029, 5.476.
13. Find the sum of 35 units, 35 tenths, 35 hundredths and 35 thousandths.
14. From 8.53 subtract 3.643.

Arrange the numbers so that the points shall be in the same column, and subtract as in whole numbers. The place of thousandths being vacant in the minuend, we borrow one from the hundredths, which is 10 thousandths, subtract 3 thousandths and carry one as in whole numbers.

$$\begin{array}{r}
 8.53 \\
 3.643 \\
 \hline
 4.887 \text{ Ans.}
 \end{array}$$

MULTIPLICATION OF DECIMALS.

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15. From 20.036 $\frac{1}{2}$ subtract 8.77 $\frac{1}{2}$.

$$\begin{array}{r} 20.036\frac{1}{2} \\ 8.773\frac{1}{2} \\ \hline 11.263\frac{1}{2} \end{array} \quad \begin{array}{c} \text{Or,} \\ \text{Ans.} \end{array} \quad \begin{array}{r} 20.036\frac{1}{2} \\ 8.773\frac{1}{2} \\ \hline 11.263\frac{1}{2} \end{array}$$

16. From 24.0042 take 13.7013.
 17. From 170.0035 take 68.00181.
 18. From .0142 take .005.
 19. What is the difference between .05 and .0024?
 20. What is the difference between 72.01 and 72.0001?
 21. From 19 take 8.998 $\frac{1}{2}$.
 22. From .4 take .04 $\frac{1}{2}$.
 23. From 2 $\frac{3}{4}$ take 1 $\frac{1}{2}$.
 24. From 1.169 $\frac{2}{5}$ take .93 $\frac{2}{5}$.
 25. What is the difference between 24 $\frac{1}{2}$ tenths and 3701 thousandths?
 26. Subtract 1 $\frac{1}{2}$ hundredths from 49 $\frac{3}{8}$ tenths.

MULTIPLICATION OF DECIMALS.

Multiply .375 by 7.

Operation by common fractions.

OPERATION.
 $\begin{array}{r} .375 \\ 7 \\ \hline \end{array}$

$$\frac{375}{1000} \times 7 = \frac{2625}{1000} = 2.625$$

Multiply 2.75 by .9.

Operation by common fractions.

OPERATION.
 $\begin{array}{r} 2.75 \\ .9 \\ \hline \end{array}$

$$2\frac{75}{100} = 2\frac{3}{4}, \text{ then, } 2\frac{3}{4} \times \frac{9}{10} = 2\frac{27}{40} = 2.675$$

Hence, to multiply decimals.

RULE.—Multiply as in whole numbers, and point off in the product as many decimal places as there are in the multiplicand and multiplier together. If there be not enough figures in the product to give the required number of decimal places, supply the deficiency by prefixing ciphers.

EXERCISES.

Multiply,

- | | |
|------------------|---------------------|
| 1. 2.54 by .34. | 6. 18.46 by 1.007. |
| 2. 4.16 by .014. | 7. .00076 by .0013. |
| 3. 4.5 by 4. | 8. 7.49 by 63.1. |
| 4. .01 by .15. | 9. .0021 by 21. |
| 5. .08 by 80. | 10. .007 by 4000. |
11. Find the continual product of .2, .2, .2, .2, .2, .2.
 12. Find the continual product of .101, .011, .11, 1.1, and 11.
 13. Multiply .144 by .144.
 14. Multiply 14.583̄ by 2.75.

In this exercise the last figure in the multiplicand is a repetend, and must be treated as such. In multiplying by 5 we must carry 1 from the product of 3 understood on the right, and the 6 in the product is a repetend. In a similar manner we carry two when we begin to multiply by 7, and the 3 in the product is also a repetend, for which reason we fill up the place on the right of the product usually left blank. Also in multiplying by 2, as the 3 in the multiplicand is a repetend, so is the 6 in the product, and we must fill up the two places on the right with 6's. Then in adding the partial products, we must allow for other columns on the right, made up of the repeating figures, and so carry 1 at the beginning.

14.583̄ 33 &c.	
2.75	
72916 66 &c.	
1020833 33 &c.	
2916666 66 &c.	
40.10416̄	

NOTE.—The above method answers very well when the multiplicand alone contains a repetend of only one figure; but when the repetend consists of more than one figure, or when there is a repetend in both multiplicand and multiplier, the process becomes complicated, and it is usual to proceed by the following

RULE.—Reduce the decimals to common fractions, and perform the multiplication required; then reduce the fraction, if any, in the product to a decimal.

Multiply,

- | | |
|----------------------|-----------------------------|
| 15. 7.416̄ by 8.5. | 18. .73̄ by 2.6̄. |
| 16. .073̄ by 7. | 19. 5.736̄ by .416̄. |
| 17. 5.638̄ by .2754. | 20. 9.4571428̄ by .538461̄. |

To multiply by 10 or any power of 10, as 100, 1000, 10000, &c.

RULE.—Move the decimal point as many places to the right as there are ciphers in the multiplier.

EXERCISES.

Multiply,

- | | |
|------------------|--------------------|
| 1. 4.5 by 10. | 4. .0625 by 1000. |
| 2. .007 by 100. | 5. 4.86 by 1000. |
| 3. 170.5 by 100. | 6. 4.83½ by 10000. |
7. One pound sterling is worth \$4.86½; what is the value of £100?
8. What will 1000 barrels of flour cost at \$6.75 per barrel?
9. What is the cost of 100 acres of land at \$17.37½ per acre?
10. What is a million pounds sterling worth at \$4.86½ each?
11. Multiply 6½ by 100000.

To multiply by 15.

Move the point ONE place to the right, and add one-half.

To multiply by 25.

Move the point TWO places to the right, and divide by 4.

To multiply by 250.

Move the point THREE places to the right, and divide by 4.

To multiply by 75.

Move the point TWO places to the right, and subtract a fourth part.

To multiply by 7½.

Move the point ONE place to the right, and subtract a fourth part.

To multiply by 12½.

Move the point TWO places to the right, and divide by 8.

To multiply by 2½.

Move the point ONE place to the right, and divide by 4.

EXERCISES.

Multiply,

- | | |
|------------------|-------------------|
| 1. 25.764 by 25. | 6. 19.50 by 2½. |
| 2. .0896 by 15. | 7. 160.5 by 150. |
| 3. .7985 by 250. | 8. .00032 by 250. |
| 4. 240.8 by 7½. | 9. 73.5 by 750. |
| 5. 5.987 by 75. | 10. 99 by 2½. |

DIVISION OF DECIMALS.

Division is the converse and proof of multiplication,—the product becoming the dividend, the multiplier or multiplicand the divisor, and the multiplicand or multiplier the quotient.

Hence, since the product contains as many decimal places as the two factors together, it follows that the dividend contains as many decimal places as the divisor and quotient together, or

The quotient must contain as many decimal places as the dividend has more than the divisor.

From this, again, it follows that the dividend must contain, at least, as many decimal figures as the divisor. Therefore,

RULE.—*When the dividend does not contain as many decimal figures as the divisor, annex ciphers to make up the number. Then divide as in whole numbers, and the quotient will be a whole number. If there be no quotient so far, or if there be a remainder, and it be desired to carry the division farther, annex as many more ciphers as necessary, continue the division, and the additional figures obtained in the quotient will be decimals.*

NOTE.—When there are not enough figures in the quotient to give the required number of decimal places, the deficiency must be supplied by prefixing ciphers.

EXAMPLE.—Divide 1728 by .12.

$$\begin{array}{r} .12 \overline{)1728.00} \\ \underline{14400} \text{ Ans.} \end{array}$$

EXERCISES.

Divide,

- | | |
|----------------------|--|
| 1. 28 by .4. | 11. 57.6 by .128. |
| 2. 21 by .5. | 12. 1.07654 by 240 to six places of decimals. |
| 3. 86.075 by 27.5. | 13. 8735.724 by .9. |
| 4. 24.73704 by 3.44. | 14. 724.573 by .7. |
| 5. .21318 by .19. | 15. 573 183 by .6. |
| 6. 9.9. by .0225. | 16. 6927.8516 by 78.5 to seven places of decimals. |
| 7. 81.2096 by 1.28. | 17. 9.6 by .55. |
| 8. 3.15 by 375. | 18. 12173.9583 by 3.1416. |
| 9. .88425 by 176.85. | |
| 10. .69201 by 7.5. | |

DIVISION OF DECIMALS.

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3.1416̄)12173.9583̄(3875 Ans.

9424 90000

2748 95000

2513 33000

235 62500

219 91600

15 70830

15 70830

.....

The above method of dividing, when the divisor contains a repetend, is somewhat tedious and requires great care. The more usual method is to reduce the repetend to a common fraction, and then divide by the mixed number. Thus,

3.1416̄)12173.9583̄(3875 Ans.

3 3

9.425) 36521.875

Divide,

19. .8̄ by 2.6̄.

21. 1.77975 by 25425.

20. 6020.06̄ by 4.86̄.

22. 3486.40 by 4.85̄.

To divide by 10 or any power of 10, as 100, 1000, 10000, &c.

RULE.—Move the decimal point as many places to the left as there are ciphers in the divisor.

EXERCISES.

Divide,

1. 3425.5 by 10.

4. 8.39 by 100.

2. 57.75 by 100.

5. .75 by 10000.

3. 1444.755 by 1000.

6. 5863.72 by 100000.

7. If it cost \$7000 to furnish a meal for an army of 100000 men, what is the cost of each man's meal?

DENOMINATE NUMBERS.

An **Abstract Number** is simply a number without reference to any object, as, 7, 16, 39, &c.

A **Concrete Number** is a number in connection with some object or objects named, as, 1 horse, 7 men, 39 ships, &c.

Denominate Numbers are concrete numbers applied to the denominations of weights and measures.

CANADIAN CURRENCY.

100 Cents (cts.) = 1 Dollar \$.

BRITISH OR STERLING CURRENCY.

TABLE.

	£	s.	d.	far.
4 Farthings = 1 Penny d.	1	= 20	= 240	= 960
12 Pence = 1 Shilling s.		1	= 12	= 48
20 Shillings = 1 Pound or Sovereign . . £			1	= 4

5 Shillings = 1 Crown, and 21 Shillings = 1 Guinea.

UNITED STATES CURRENCY.

TABLE.

	E.	\$	d.	cts.	Mills.
10 Mills = 1 Cent ct.	1	= 10	= 100	= 1000	= 10000
10 Cents = 1 Dime d.		1	= 10	= 100	= 1000
10 Dimes = 1 Dollar \$			1	= 10	= 100
10 Dollars = 1 Eagle E.				1	= 10

NOTE.—Although the above is in theory the U. S. table of currency, in practice it is the same as that of Canada.

DOMINION STANDARDS OF WEIGHT.

The legal standards of weight in the Dominion of Canada are the Imperial pound, Avoirdupois, containing 7000 grains, and the ounce Troy, containing 480 grains.

The Dominion Standard for determining the weight of the Dominion standard pound is of platinum-iridium, the form being that of a cylinder nearly 1.35 inch in height, and 1.15 inch in diameter, with a groove or channel round it, whose middle is about 0.34 inch below the top of the cylinder, for insertion of the points of the ivory fork by which it is to be lifted; the edges are carefully rounded off, and such standard pound is marked "A." The weight of this standard in terms of the Imperial standard is 6999.97694 grains when both are weighed *in vacuo*, and 6999.98387 grains when both are weighed in air at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 inches, and for which due allowance is to be made when comparing other standards.

The Dominion Standard for determining the weight of the Dominion standard troy ounce is of platinum-iridium, the form being that of a truncated cone, with a knob, nearly $\frac{1}{8}$ ths of an inch in height, including the knob, the knob being nearly $\frac{1}{4}$ inch, and the base of the cone $\frac{1}{2}$ inch in diameter, respectively, and such standard troy ounce is marked "A." The weight of this standard in terms of the Imperial standard is 479.99197 grains when both are weighed *in vacuo*, and 480.03648 grains when both are weighed in air at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 inches, for which due allowance is to be made when comparing other standards.—*Weights and Measures Act of 1879.*

AVOIRDUPOIS WEIGHT.

Avoirdupois Weight is used in weighing all articles except gold, silver, platinum and precious stones, and articles made thereof.

TABLE.

16 Drams (<i>drs.</i>)	= 1 Ounce.....oz.
16 Ounces	= 1 Pound.....lb.
100 Pounds	= { 1 Hundred-weight... <i>cwt.</i> 1 Cental..... <i>C.</i>
20 Hundred-weight	= 1 Ton..... <i>T.</i>

<i>T.</i>	<i>cwt.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>
1	= 20	= 2000	= 32000	= 512000
	1	= 100	= 160	= 25600
		1	= 16	= 256
			1	= 16

DENOMINATE NUMBERS.

BRITISH TABLE.

16 dr.	= 1 oz.	T.	cwt.	qr.	lb.	oz.	dr.
16 oz.	= 1 lb.	1	= 20	= 80	= 2240	= 35840	= 573440
28 lb.	= 1 qr.		1	= 4	= 112	= 1792	= 28672
4 qr. or } 112 lb.	= 1 cwt.			1	= 28	= 448	= 7168
20 cwt.	= 1 ton.				1	= 16	= 256
						1	= 16

The British table has been used in this country, and still is in a few exceptional cases. There is, however, a good deal of use for it, as goods bought in Great Britain are invoiced by this method. 112 lbs. are a quintal of fish; and coal is sold at the mines by the ton of 2240 lbs., or 20 cwt. of 112 lbs. each. By the "Weights and Measures Act of 1879," the legal ton is fixed at 2000 lbs., and no other is lawful. This will probably have the effect of doing away with the "long ton" in weighing coal, as well as other articles. In Great Britain, 14 lbs. make 1 stone.

The measure of a ton of freight is 40 cubic feet. This measurement is applied to general merchandise and all light articles.

Freight of heavy substances, as iron, coal, &c., is by the ton avoirdupois, and is distinguished from the ton measurement, as "dead weight."

The register tonnage of vessels is expressed in tons of 100 cubic feet, internal measurement.

Vessels are reckoned to carry of measured tons about $1\frac{1}{2}$ for every ton register, and of dead weight about $1\frac{1}{2}$ for every ton register.

TROY WEIGHT.

Troy Weight is used in weighing gold, silver, platinum and precious stones, and articles made thereof.

TABLE.

		lb.	oz.	pwt.	gr.
24 Grains (<i>gr.</i>)	= 1 Pennyweight.	1	= 12	= 240	= 5760
20 Pennyweights	= 1 Ounce		1	= 20	= 480
12 Ounces	= 1 Pound			1	= 24

APOTHECARIES' WEIGHT.

Apothecaries mix their medicines by this weight, using the ounce Troy, but they buy and sell by Avoirdupois.

LINEAR OR LONG MEASURE.

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TABLE.

		lb.	℥.	3.	℥.	gr.
20 Grains (<i>gr.</i>)	= 1 Scruple . . . ℥.	1	= 12	= 96	= 288	= 5760
3 Scruples	= 1 Dram . . . 3.		1	= 8	= 24	= 480
8 Drams	= 1 Ounce . . . ℥.			1	= 3	= 60
12 Ounces	= 1 Pound . . . lb.				1	= 20

LINEAR OR LONG MEASURE.

Theoretically, the yard is equal to $\frac{1}{3600000}$ of the length of a pendulum that vibrates seconds in a vacuum, at the level of the sea in the latitude of London.

The Imperial yard is the standard measure of length, from which all other measures of length, whether lineal, superficial or solid, are derived.

The Dominion Standard for determining the length of the Dominion standard yard is a solid square bar, thirty-eight inches long and one inch square in transverse section, the bar being of bronze or gun metal (known as Baily's metal); near to each end a cylindrical hole is sunk (the distance between the centres of the two holes being thirty-six inches) to the depth of half an inch; at the bottom of each hole is inserted in a smaller hole a gold plug or pin, about one-tenth of an inch in diameter, and upon the surface of each pin are cut a fine line transverse to the axis of the bar, and two lines at an interval of about one-hundredth of an inch parallel to the axis of the bar, the measure of length of the Dominion standard yard is given by the interval between the transverse line at one end and the transverse line at the other end, the part of each line which is employed being the point midway between the longitudinal lines; and the said points are in this Act referred to as the centres of the said gold plugs or pins, and such bar is marked "Mr. Baily's metal," "Standard Yard," "A," "Troughton and Simms, London." There are also, on the upper side of the bar, two holes for the insertion of the bulbs of suitable thermometers for the determination of the temperature.—*Weights and Measures Act of 1879.*

TABLE.

12 Inches (<i>in.</i>)	= 1 Foot	<i>ft.</i>
3 Feet	= 1 Yard	<i>yd.</i>
5½ Yards	= 1 Rod, Pole, or Perch	<i>rd.</i>
40 Rods	= 1 Furlong	<i>fur.</i>
8 Furlongs	= 1 Mile	<i>m.</i>

DENOMINATE NUMBERS.

<i>m.</i>	<i>fur.</i>	<i>rd.</i>	<i>yd.</i>	<i>ft.</i>	<i>in.</i>
1	= 8	= 320	= 1760	= 5280	= 63360
	1	= 40	= 220	= 660	= 7920
		1	= 5½	= 16½	= 198
			1	= 3	= 36
				1	= 12

NOTES.—1. The inch is usually divided into halves, quarters, eighths, and sixteenths.

2. In measuring "dry goods" the yard is usually divided into halves, quarters, eighths, and sixteenths.

3. The mile of the table is that fixed by law, in England, Canada, and the United States, and is therefore often spoken of as the statute mile.

4. A Hand = 4 inches, used in measuring the height of horses. A Fathom = 6 feet, used in measuring cordage and depths at sea. A Cable-length = 120 fathoms, or 240 yards.

5. French measures are recognized for the measures of length and superficies, for land comprised in those parts of the Province of Quebec originally granted under the Seigniorial tenure—the foot, "French measure" or "Paris foot" being equal to 12.79 inches of the Dominion standard. The "Arpent," when used as a measure of length is 180 French feet; and when used as a measure of superficies is 32400 square French feet. The Perch, as a measure of length, is equal to 18 French feet, and as a measure of superficies is equal to 324 square French feet.

SURVEYORS' LINEAR MEASURE.

Surveyors' Linear Measure is used in measuring lands, roads, &c.

The unit used, which is also the instrument for measuring, is a chain, 4 rods, or 66 feet long, called Gunter's Chain. It is divided into 100 links, each 7.92 inches in length.

TABLE.

	<i>m.</i>	<i>ch.</i>	<i>l.</i>	<i>in.</i>
100 Links (<i>l.</i>) = 1 Chain <i>ch.</i>	1	= 80	= 8000	= 63360
80 Chains = 1 Mile <i>m.</i>		1	= 100	= 792
			1	= 7.92

NOTE.—Links are written decimally as hundredths of a chain.

SQUARE MEASURE.

Square Measure is used in measuring surfaces.

CUBIC OR SOLID MEASURE.

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The unit for this measure is a square whose side is some linear unit. Thus, a square foot is a square whose side is 1 linear foot, and a square mile is a square whose side is one mile in length.

TABLE.

144 Square Inches (<i>sq. in.</i>)	=	1 Square Foot	 <i>sq. ft.</i>
9 " Feet	=	1 " Yard	 <i>sq. yd.</i>
30½ " Yards	=	1 " Rod	 <i>sq. rd.</i>
102400 " Rods	=	1 " Mile	 <i>sq. m.</i>

SURVEYORS' SQUARE MEASURE, Or LAND MEASURE.

For small areas of land, the square foot, yard and rod are used as in the above table. For larger areas, as below.

TABLE.

10000 Square Links (<i>sq. l.</i>)	=	1 Square Chain	 <i>sq. ch.</i>
10 Square Chains	=	1 Acre	 <i>a.</i>
640 Acres	=	1 Square Mile	 <i>sq. m.</i>

NOTE.—An acre, which is the common unit of land measure, is equal to 160 square rods. A rod is $\frac{1}{4}$ of an acre, or 40 square rods. The term rod is not much used.

CUBIC OR SOLID MEASURE.

Cubic or Solid Measure is used in measuring the volume or contents of bodies having length, breadth and thickness, or height or depth.

The unit for this measure is a cube, each of whose sides is the square of some linear unit. Thus, a cubic foot is a cube, each of whose six sides is a square foot, that is, the square of a linear foot.

TABLE.

1728 Cubic Inches (<i>cu. in.</i>)	=	1 Cubic Foot	 <i>cu. ft.</i>
27 Cubic Feet	=	1 Cubic Yard	 <i>cu. yd.</i>

NOTE.—128 cubic feet are 1 cord of wood or bark. Such cords are usually measured by piling sticks of wood or bark 4 feet long, into piles 4 feet high and 8 feet long.

MEASURE OF CAPACITY.

The **Measure of Capacity** includes Liquid Measure and Dry Measure. The former is used for measuring liquids, and the latter for measuring such commodities as grains, salt, roots, fruits, &c.

The Dominion Standard Measure of Capacity is the Imperial Gallon, containing 10 pounds weight of distilled water, weighed in air, against brass weights, with the water and air at the temperature of 62 degrees Fahrenheit, and with the barometer at 30 inches.

The Imperial or Standard Gallon contains 277.274 cubic inches.

The Standard Gallon of the United States (which was also until recently the standard in Canada) is the Wine Gallon, containing 231 cubic inches. It will therefore be seen that

$$12 \text{ Wine Gallons} = 10 \text{ Standard Gallons.}$$

Therefore, to reduce Wine Gallons in Imperial Gallons,

Deduct $\frac{1}{10}$, and

To reduce Imperial Gallons to Wine Gallons,

Add $\frac{1}{10}$.

Since 8 standard gallons = 1 standard bushel, the standard bushel contains 2218.192 cubic inches, which is the Imperial bushel of England.

In the United States the Winchester bushel containing 2150.42 cubic inches, is used.

LIQUID MEASURE.

TABLE.

4 Gills (<i>g.</i>) = 1 Pint,.....	<i>pt.</i>	<i>gal.</i>	<i>qrt.</i>	<i>pt.</i>	<i>g.</i>
2 Pints = 1 Quart.....	<i>qrt.</i>	1	= 4	= 8	= 32
4 Quarts = 1 Gallon.....	<i>gal.</i>		1	= 2	= 8
25 Gallons = 1 Barrel.....	<i>ddl.</i>			1	= 4

APOTHECARIES' FLUID MEASURE.

The British Pharmacopœia is adopted by the Pharmaceutical Society of Nova Scotia, and is understood to be used in all prescriptions, unless otherwise specified.

PRODUCE WEIGHT.

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TABLE.

1 Minim (m.)	=	.91 Grains.		
60 Minims	=	54.68	"	= 1 Fluid Dram . . <i>fl. dr.</i> or <i>f. 3.</i>
8 Fluid Drams	=	437.5	"	= 1 Fluid Ounce . . <i>fl. oz.</i> or <i>f. 3.</i>
20 Fluid Ounces	=	1 $\frac{1}{4}$ lb.		= 1 Pint <i>pt.</i> or <i>O.</i>
8 Pints	=	10	"	= 1 Gallon <i>gal.</i> or <i>C.</i>
Also, 16 Fluid Ounces = 1 Fluid Pound.				

The ounce and pound are equivalent to the ounce and pound avoirdupois, which are used in custom.

The gallon is the Imperial gallon, containing 277.274 cubic inches.

DRY MEASURE.

TABLE.

2 Pints (<i>pt.</i>)	= 1 Quart . . <i>qrt.</i>	<i>ddl.</i>	<i>bush.</i>	<i>pk.</i>	<i>gal.</i>	<i>qrt.</i>	<i>pt.</i>
4 Quarts	= 1 Gallon . . <i>gal.</i>	1	= 3 $\frac{1}{8}$	= 12 $\frac{1}{2}$	= 25	= 100	= 200
2 Gals. or	} = 1 Peck . . . <i>pk.</i>	1	= 4	= 8	= 32	= 64	
8 Quarts			1	= 2	= 8	= 16	
4 Pecks	= 1 Bushel . . <i>bush.</i>			1	= 4	= 8	
3 $\frac{1}{8}$ Bushels	= 1 Barrel . . <i>ddl.</i>				1	= 2	

Although the "Weights and Measures Act of 1879" fixes the barrel at 25 standard gallons, in commerce neither the barrel nor the hogshead is a fixed measure, but their capacity is found by guaging or actual measurement.

PRODUCE WEIGHT.

By the "Weights and Measures Act of 1879," the weights of produce are fixed as in the following table, and it is enacted that "in contracts for the sale and delivery of any of the undermentioned articles, the bushel shall be determined by weighing, unless a bushel by measure be specially agreed upon."

TABLE.

<i>Commodities.</i>	<i>lb.</i>	<i>Commodities.</i>	<i>lb.</i>	<i>Commodities.</i>	<i>lb.</i>
Wheat	60	Beans	60	Castor Beans	40
Indian Corn	56	Clover Seed	60	Potatoes	60
Rye	56	Timothy Seed	48	Turnips	60
Barley	48	Flax Seed	50	Parsnips	60
Pease	60	Buckwheat	48	Carrots	60
Malt	36	Hemp Seed	44	Beets	60
Oats	34	Blue Grass Seed . .	14	Onions	60

Heaped measures are not lawful. Measures of grains or small seeds must be stricken with a round, straight stick; and where the size or shape of the article measured will not admit of the measure being stricken, "it shall be filled in all parts as nearly to the level of the brim as the size and shape of the article will admit."

MEASURE OF TIME.

The natural divisions of time are the **Solar Year** and the **Solar Day**.

The **Solar Year** is the time in which the earth makes one revolution around the sun.

The **Solar Day** is the time in which the earth performs one revolution on its axis, and is not of exact uniform length at all seasons of the year. The average of all the days is taken as the length of each in measuring time for civil purposes.

TABLE.

60 Seconds (<i>s.</i>)	= 1 Minute	<i>m.</i>
60 Minutes	= 1 Hour	<i>h.</i>
24 Hours	= 1 Day	<i>d.</i>
365 Days	= 1 Common Year	<i>y.</i>

Also, 7 days = 1 week; 52 weeks and 1 day = 1 year; 12 calendar months = 1 year; 100 years = 1 century.

The above divisions of time make the year consist of 365 days; but the solar year is 365 *d.* 5 *h.* 48 *m.* 50 *s.*, or nearly 365½ days. To prevent the loss of ½ of a day each year, Julius Cæsar, in *n. c.* 46, established the calendar which makes every fourth year one day longer, or 366 days. This long year, which occurs every year whose number is exactly divisible by 4, is called leap year. But this correction is too great by 11 *m.* 10 *s.* per year, making an opposite error of about 3 days in 400 years. The error had amounted to 10 days in the time of Pope Gregory XIII. who, to correct it, decreed that 10 days should be omitted from October, 1582, and, to prevent future error, it was further decreed that the leap year should be omitted 3 times in every 400 years, that is to say, that only such centennial years as are exactly divisible by 400, as 1600, 2000, 2400, &c., should be leap years.

The calendar of Julius Cæsar is known as the Julian Calendar or Old Style, and is still in use in Russia. That of Gregory is known as the Gregorian Calendar or New Style, and is in use in all other civilized countries.

Since the original difference in 1582 was 10 days, and as the years 1700 and 1800 were leap years by the old style and not by the new, the difference is now 12 days. Any date is therefore 12 days later in Russia than in other countries.

MARINE, ANGULAR OR CIRCULAR MEASURE, 51

THE CALENDAR MONTHS OF THE YEAR.

January has.....31 days.	July has....31 days.
February " 28 "	August " 31 "
" in leap year..29 "	September " 30 "
March has.....31 "	October " 31 "
April " 30 "	November " 30 "
May " 31 "	December " 31 "
June " 30 "	

RULE FOR FINDING THE LEAP YEAR.—*Divide the two right hand figures of the number denoting the year by 4; if there be no remainder, it is leap year.*

EXCEPTION.—No centennial year, that is, no year whose number ends in two ciphers, is leap year, except its number can be divided by 400 without a remainder.

MARINE, ANGULAR OR CIRCULAR MEASURE.

The unit of this measure is the degree which is $\frac{1}{360}$ of the circumference of any circle.

TABLE.

60 Seconds (")	= 1 Minute or Mile.....'
60 Minutes	= 1 Degree°
360 Degrees	= 1 Circle.....C.

Also, $11^{\circ}15'$ = 1 point of the Compass, and 32 points = 1 Circle.

A quadrant is one-fourth of a circle, or 90 degrees.

A sextant is one-sixth of a circle, or 60 degrees.

Among seamen a fathom is 6 feet, and a knot is a division of the log line, about 47 feet in length, used in expressing the rate of a vessel's speed. When a ship sails at the rate of 6 miles an hour, her speed is said to be 6 knots.

A degree of latitude, or of longitude on the equator is $\frac{1}{360}$ of the earth's circumference. $\frac{1}{60}$ of this degree is a minute or marine mile, equal to 1.15 statute miles, or about 2025 yards. 3 miles = 1 league.

MISCELLANEOUS MEASURES.

12 Articles	= 1 Dozen.
20 "	= 1 Score.
144 "	= 1 Gross.
24 Sheets of Paper	= 1 Quire.
20 Quires	= 1 Ream.
196 lbs. Flour	= 1 Barrel.
200 " Beef or Pork	= 1 Barrel.
100 " Nails	= 1 Keg.

OF BOOKS.

A sheet folded in 2 leaves is called a folio.

"	"	4	"	"	quarto, or 4 to.
"	"	8	"	"	an octavo, or 8 vo.
"	"	12	"	"	a duodecimo, or 12 mo.
"	"	18	"	"	an 18 mo.

THE METRIC SYSTEM.

The **Metric System** of weights and measures is a system employing entirely the decimal notation. By this system, throughout all the tables, 10, (or 100 in square measure, or 1000 in cubic measure) of one denomination, make one of the next higher; which fact enables the denominations to be written in decimal form, and added, subtracted, multiplied and divided with the same facility as simple numbers. It is, without doubt, destined to come into universal use. It has already superseded the more complex and variable systems formerly in use in several countries of Europe and America, and has been legalized and partially adopted in many more, including Great Britain, Canada and the United States.

The **Metre** is the basis of the system, and gives it its name. It is the unit of the measure of length, and is equal to one-ten-millionth part of the length of a meridian between the equator and the pole.

To assist the student in learning the names of the denominations, it may be noted that there are only four units to remember, viz: the Metre (length), the Are (land surface), the Gram (weight), and the Litre (capacity). The names of the denominations which are divisions of these are formed, beginning with the lowest, by prefixing to the units the Latin numerals, milli, $\frac{1}{1000}$; centi, $\frac{1}{100}$; deci, $\frac{1}{10}$; and the higher denominations, or multiples of the units, are formed in like manner, by prefixing the Greek numerals, deca, 10; hecto, 100; kilo, 1000; and myria, 10000.

LINEAR MEASURE.

TABLE.

	METRES.	
1 Millimetre (<i>mm</i>)	$\frac{1}{1000} =$	.039382 Inches.
10 <i>mm.</i> = 1 Centimetre (<i>cm.</i>)	$\frac{1}{100} =$	.39382 "
10 <i>cm.</i> = 1 Decimetre (<i>dm.</i>)	$\frac{1}{10} =$	3.9382 "
10 <i>dm.</i> = 1 METRE (<i>m.</i>)	1 =	3.281833 Feet.
10 <i>m.</i> = 1 Decametre (<i>Dm.</i>)	10 =	32.818333 "
10 <i>Dm.</i> = 1 Hectometre (<i>Hm.</i>)	100 =	109.394444 Yards.
10 <i>Hm.</i> = 1 Kilometre (<i>Km.</i>)	1000 =	1093.944444 "
10 <i>Km.</i> = 1 Myriametre (<i>Mm.</i>)	10000 =	6.215593 Miles.

The Metre, like the yard, is used in expressing the measurements of cloths, ribbons and short distances.

The kilometre, equal to about $\frac{3}{4}$ of a mile, is used as the unit for long distances.

SQUARE MEASURE.

100 Square Centimetres (*sq. cm.*) = 1 Square Decimetre = 15.5 sq. in.
 100 " Decimetres (*sq. dm.*) = 1 SQUARE METRE (*sq. m.*) = 1.1967 sq. yds

The square metre is used in measuring floorings, ceilings, &c., taking the place of the square yard.

The square decimetre, and the square centimetre are used for smaller surfaces.

LAND MEASURE.

TABLE.

1 Centaro (1 Square Metre)	=	1551 sq. in.
100 Centares (ca.) = 1 Are	(100 " ")	= 119.67 sq. yds.
100 Ares (a)	= 1 Hectare (10000 " ")	= 2.4725 Acres.

The hectare is the ordinary unit for lands, although the are is the nominal unit.

CUBIC MEASURE.

TABLE.

1000 Cu. Millimetres (cu. mm.)	= 1 Cu. Centimetre	= .061 cu. in.
1000 Cu. Centimetres (cu. cm.)	= 1 Cu. Decimetre	= 61.079 cu. in.
1000 Cu. Decimetres (cu. dm.)	= 1 Cu. METRE	= { 35.346 cu. ft. 1.309 cu. yds.

DRY AND LIQUID MEASURE.

The unit of Dry and Liquid Measure is the litre, equal to a cubic decimetre, or .2202 of a standard gallon, or .8808 of a quart.

TABLE.

LITRES.			
1 Millilitre, $\frac{1}{1000}$	=	.061068 cu. in., or	.035219 fl. oz.
10 ml. = 1 Centilitre, $\frac{1}{100}$	=	.61068 cu. in., or	.35219 fl. oz.
10 cl. = 1 Decilitre, $\frac{1}{10}$	=	6.1068 cu. in., or	.70478 gill.
10 dl. = 1 LITRE, 1	=	1.7619 pt., or	.881 qrt.
10 l. = 1 Decalitre, 10	=	1.10122 pk., or	2.202 gal.
10 Dl. = 1 Hectolitre, 100	=	2.753 bush., or	22.024 gal.
10 Hl. = 1 Kilolitre, 1000	=	27.53 bush., or	220.244 gal.

The litre is used in measuring liquors, milk, &c. It is about equal to the old wine quart.

The hectolitre, equal to about 2½ bushels, is used in measuring grain.

WEIGHT.

The unit of weight is the **gram**, which is the weight of a cubic centimetre of distilled water in a vacuum, at a temperature of 39.2° Fahrenheit. It is equal to 15.432 grains.

TABLE.

GRAMS.				
	1 Milligram ..	$\frac{1}{1000}$	=	.01543 gr.
10 mg.	= 1 Centigram ..	$\frac{1}{100}$	=	.1543 gr.
10 cg.	= 1 Decigram ..	$\frac{1}{10}$	=	1.543 gr.
10 dg.	= 1 GRAM	1	=	15.432 gr.
10 g.	= 1 Decagram ..	10	=	.3527 oz. Av.
10 Dg.	= 1 Hectogram ..	100	=	3.5274 oz. Av.
10 Hg.	= { 1 Kilogram, } or Kilo }	1000	=	{ 2.6792 lb. Tr. 2.2046 lb. Av.
10 Kg.	= 1 Myriagram ..	10000	=	22.046 lb. Av.
10 Mg., or 100 Kilos }	= 1 Quintal	100000	=	220.46 lb. Av.
10 Q., or 1000 Kilos }	= { 1 Tonneau, } or Ton }	1000000	=	{ 2204.6 lb. Av. 1.1023 T.

The above table is used in computing the weights of all objects, from the smallest atom to the largest known body. The gram, kilogram (or kilo), and ton are the units used according to the substance whose weight is computed.

The gram is used in weighing letters, gold, silver, precious stones and medicines.

The kilogram is used in weighing groceries and course articles. It is about $2\frac{1}{2}$ lbs. av.

The ton is the weight of a cubic metre of water, and is used in weighing very heavy articles, as coal, iron, &c. It is about $1\frac{1}{10}$ ordinary tons.

REDUCTION OF DENOMINATE NUMBERS.

Reduction is the process of changing the denomination of a quantity without altering its value.

Reduction may be considered as of two kinds—REDUCTION DESCENDING and REDUCTION ASCENDING.

Reduction Descending consists in reducing a quantity to a *lower* denomination than that in which it is expressed. Thus, reducing dollars to cents, pounds to shillings, tons to ounces, bushels to quarts, &c., is Reduction Descending.

Reduction Ascending consists in reducing a quantity to a *higher* denomination than that in which it is expressed. Thus, reducing cents to dollars, pence to shillings, ounces to pounds, quarts to gallons, &c., is Reduction Ascending.

RULE FOR REDUCTION DESCENDING.—*Multiply the highest denomination given by that number which expresses how many of the next lower denomination make 1 of this higher, and to the product add the number, if any, in the lower denomination.*

Treat the result, and the successive results obtained, in the same way in regard to lower denominations to which the reduction is to be extended, until the required denomination is reached.

EXAMPLE.—1. Reduce £26 to shillings.

£26 We multiply by 20 because there are 20 shillings in £1, that
 20 is, 20 of the lower name make one of the higher. Or, because,
 520 s. since there are 20 shillings in £1, there are 26 times 20, or 20
 times 26 shillings in £26.

EXAMPLE.—2. Reduce 18 days, 10 h. 23 m. 40 sec. to seconds.

18 d. 10 h. 23 m. 40 s.
 24
 442 h. Multiply by 24, because 24 hours make 1 day. Add in
 60 10 hours. Multiply by 60, because 60 m. make 1 hour.
 26543 m. Add in 23 minutes. Multiply by 60, because 60 sec. make
 60 1 minute. Add in 40 seconds.
 1592620 s.

EXERCISES.

Reduce :

1. £25 12s. to pence.
2. £325 19s. 7d. to pence.
3. £19 to farthings.
4. £27 17s. 11½d. to farthings.
5. £128 4s. 10d. to pence.
6. 18s. 4½d. to farthings.
7. \$273 to cents.
8. \$478.25 to cents.
9. \$16 to mills.
10. 17 ea. 7 dol. 3d. to cents.
11. 3 tons, 17 cwt. to pounds.
12. 759 lbs. 7 oz. 12 dr. to drams.
13. 18 tons to ounces.
14. 24 cwt. 1 qr. 18 lb. to pounds.
15. 13 tons 16 cwt. 3 qr. 26 lb. to pounds.

16. 4 tons 7 cwt. 73 lb. to pounds.
17. 25 lb. Troy to grains.
18. 6 lb. 8 oz. 15 pwt. to pennyweights.
19. 3 oz. 16 pwt. 18 gr. to grains.
20. 25 lb. to grains by Apothecaries' table.
21. 5 lb. 6 oz. 4 dr. 1 scr. 8 gr. to grains.
22. 7 oz. to scruples.
23. 25 bushels of wheat to pounds.
24. 245 bushels of oats to pounds.
25. 17 bushels of potatoes to pounds.
26. 7 miles to rods.
27. 40 rods to yards.
28. 47 miles to feet.
29. 15 m. 5 f. 35 rd. 3 yd. 1 ft. 7 in. to inches.
30. 3 m. 6 f. 27 rd. 4 yd. 2 ft. to feet.
31. 31 miles 50 chains 4 links to links.
32. $11\frac{1}{4}$ miles to chains.
33. 12 sq. rd. to square feet.
34. 6 sq. miles to square yards.
35. 54 sq. yd. to square inches.
36. 3 acres to square rods.
37. 1 sq. m. 37 sq. rd. 20 sq. yd. 6 sq. ft. 112 sq. in. to inches.
38. 20 sq. m. to square chains.
39. 4 sq. ch. to square links.
40. 27 acres to square chains.
41. 147 a. 6 sq. ch. to square links.
42. 12 cu. yd. to cubic inches.
43. 419 cu. ft. to cubic inches.
44. 75 gallons to pints.
45. 15 barrels to quarts.
46. 21 gal. 3 qrt. 1 pt. 2 g. to gills.
47. 216 wine gallons to standard gallons.
48. 480 wine gallons to standard gallons.
49. 760 wine gallons to standard gallons.
50. 120 standard gallons to wine gallons.
51. 25 standard gallons to wine gallons.
52. 126 standard gallons to wine gallons.
53. 17 bush. to quarts.
54. 12 bush. 3 pk. 5 qrt. to pints.

55. 40 bush. 1 pk. to pints.
56. 1873 years ($365\frac{1}{4}$ d.) to days.
57. 240 d. 12 h. 42 m. 36 s. to seconds.
58. 2 y. 136 d. 16 h. 9 m. to minutes.
59. $47^{\circ} 50' 25''$ to seconds.
60. $58^{\circ} 24' 50''$ to seconds.
61. 5 reams paper to sheets.
62. $12\frac{1}{2}$ reams to quires.
63. How many days in the first six months of the year?
64. How many days in the last six months of the year?

RULE FOR REDUCTION ASCENDING.—*Divide the given number by that number which expresses how many of that denomination make 1 of the next higher, reserving the remainder, if any, as part of the answer.*

Treat the quotient, and the successive quotients obtained in the same way in regard to higher denominations to which the reduction is to be extended, until the required denomination is reached. The last quotient with the remainders will form the answer.

EXAMPLE.—1. Reduce 520 shillings to pounds.

2.0) 52.0

£26 Ans.

Since there are 20 shillings in £1 the number of pounds in any number of shillings is $\frac{1}{20}$ of the number of shillings; and this is found by dividing by 20.

EXAMPLE.—2. Reduce 1592620 seconds to days.

6.0) 159262.0s.

6 0) 2654.3m. 40s.

24) 442h. 23m. 40s.

24

202 (18 d. 10 h 23 m. 40 s. Ans.

192

10h.

1st step, from seconds to minutes—divide by 60 because the number of minutes will be $\frac{1}{60}$ of the number of seconds. This gives the minutes and a remainder of 40 s.

2nd step, from minutes to hours—divide by 60 because the number of hours will be $\frac{1}{60}$ of the number of minutes. This gives the hours and a remainder of 23 m. 40 s.

3rd step, from *hours* to *days*—divide by 24 because the number of days will be $\frac{1}{24}$ of the number of hours. This gives 18 *d.* and a remainder of 10 *h.* 23 *m.* 40 *s.* The answer is, therefore, 18 *d.* 10 *h.* 23 *m.* 40 *s.*

The remainder after each division is of the same name as the dividend.

EXERCISES.

Reduce :

1. 6144 pence to pounds.
2. 78235 pence to pounds.
3. 18240 furthings to pounds.
4. 26781 farthings to pounds.
5. 30778 pence to pounds.
6. 882 farthing to shillings.
7. 27300 cents to dollars.
8. 47825 cents to dollars.
9. 16000 mills to dollars.
10. 17730 cents to eagles.
11. 7700 *lb.* to tons.
12. 194428 *dr.* to pounds.
13. 576000 *oz.* to tons.
14. 2734 *lb.* to *cwt.* (English table).
15. 31022 *lb.* to tons (English table).
16. 8773 *lb.* to tons.
17. 144000 *gr.* to pounds Troy.
18. 1615 *gr.* to *lb.* Troy.
19. 1842 *gr.* to ounces.
20. 144000 *gr.* to pounds by apothecaries' table.
21. 31948 *gr.* to pounds by apothecaries' table.
22. 168 *scr.* to ounces.
23. 1500 *lb.* of wheat to bushels.
24. 8330 *lb.* of oats to bushels.
25. 1020 *lb.* of potatoes to bushels.
26. 2240 rods to miles.
27. 220 *yd.* to rods.
28. 248160 *ft.* to miles.
29. 997057 *in.* to miles, &c.
30. 20257½ *ft.* to miles, &c.

DENOMINATE NUMBERS.

31. 253004 links to miles, &c.
32. 900 chains to miles.
33. 3267 *sq. ft.* to *sq. rods*.
34. 614400 *sq. rods* to *sq. miles*.
35. 69984 *sq. in.* to *sq. yards*.
36. 480 *sq. rods* to acres.
37. 4015967044 *sq. in.* to *sq. miles*, &c.
38. 128000 *sq. ch.* to *sq. miles*.
39. 40000 *sq. links* to *sq. chains*.
40. 270 *sq. ch.* to acres.
41. 14760000 *sq. links* to acres.
42. 559872 *cu. in.* to *cu. yards*.
43. 724032 *cu. in.* to *cu. feet*.
44. 600 *pt.* to gallons.
45. 1500 *qrt.* to barrels.
46. 702 gills to gallons, &c.
47. 180 standard *gal.* to wine gallons.
48. 400 " " to " "
49. 633½ " " to " "
50. 144 wine *gal.* to standard gallons.
51. 30 " " to " "
52. 151½ " " to " "
53. 544 *qrt.* to bushels.
54. 826 *pt.* to bushels, &c.
55. 2576 *pt.* to bushels, &c.
56. 684113½ days to years of 365½ *d.* each.
57. 20781756 seconds to days.
58. 1248009 *m.* to years.
59. 172225" to degrees.
60. 201290" to degrees.
61. 24000 sheets of paper to reams.
62. 250 quires of paper to reams.

MISCELLANEOUS EXERCISES.

1. How many pounds in 2 *t.* 16 *cwt.*, 71 *lb.*?
2. Reduce £65 13s. 7d. to pence.
3. Reduce 14796 *lb.* to tons, &c.

4. Reduce 13285 pence to pounds.
5. Reduce 3057200 oz. to tons, &c.
6. How many grains are there in 17 lb., 11 oz., 18 pwt., 22 gr.?
7. Reduce 35840 lb. to tons, by the British table.
8. Reduce 98 m., 5 f., 30 rd., to rods.
9. In 7 t., 14 cwt., 3 qr., 18 lb., how many pounds?
10. How many acres, &c., in 479685971 sq. inches?
11. How many ounces in 20 tons?
12. Reduce 527168 feet to miles, &c.
13. Reduce $\frac{2}{3}$ of a pound Avoirdupois to ounces.

The rules already given are good for fractions as well as whole numbers.

$$\frac{2}{3} \times 16 = 10\frac{2}{3} \text{ oz. Ans.}$$

14. Reduce $\frac{5}{8}$ of a dollar to cents.
15. Reduce $\frac{7}{16}$ of a ton to ounces.
16. What is the value of $\frac{5}{8}$ of a pound sterling?

$$\text{£} \frac{5 \times 20}{8} = \frac{25}{2} = 12\frac{1}{2} \text{ s.}$$

$$\frac{1 \times 12}{2} = 6 \text{ d.}$$

Ans. 12s. 6d.

17. What is the value of $\frac{7}{8}$ of a pound sterling?
18. Reduce $\frac{7}{8}$ of a pound sterling to its value in shillings and pence.
19. Reduce $\frac{3}{4}$ of a pound sterling to its value in shillings and pence.
20. Reduce $\frac{7}{16}$ of an acre to sq. rods.
21. Reduce $\frac{5}{8}$ of a shilling to the fraction of a pound.

$$\frac{5}{8} \times 20 = \text{£} \frac{1}{4} \text{ Ans.}$$

22. What is the value of $\frac{7}{12}$ of a ton.
23. What is the value of $\frac{9}{16}$ of a yard.
24. What is the value of $\frac{2}{3}$ of a pound Troy.
25. Find the value of $\frac{6}{13}$ of a shilling.
26. Reduce $\frac{3}{4}$ of a dollar to its value in cents.
27. Reduce 40 lbs. to the fraction of a cwt.

Divide 40 by 100, thus, $\frac{40}{100} = \frac{2}{5} \text{ cwt. Ans.}$

28. Reduce 12 shillings to the fraction of a pound.
29. Reduce 9d. to the fraction of a shilling.
30. Reduce 6 oz. to the fraction of a pound, Avoirdupois.
31. Reduce 10d. sterling to the fraction of a pound.
32. Reduce 35 lb. to the fraction of a ton.
33. Reduce 5 days to the fraction of a year.
34. What part of a bushel of wheat is 25 lb.?
35. Reduce 4235 sq. yards to acres.
36. Reduce 12s. 6d. to the fraction of a pound.

Begin with the lowest denomination, 6d., reduce it to shillings as you would any other number of pence, that is divide it by 12. Now the only way you can divide 6 by 12 is by making 6 the numerator and 12 the denominator of a fraction, thus, $\frac{6}{12}$, which, when reduced, is $\frac{1}{2}$. 12s. 6d., therefore, is $12\frac{1}{2}$ s. Reduce this to pounds by dividing by 20, that is, make $12\frac{1}{2}$ the numerator of a fraction, and 20 the denominator; thus, $\frac{12\frac{1}{2}}{20}$, a complex fraction; reduce it, and it becomes $\frac{5}{8}$, which is the answer. See the work:

$$12\frac{1}{2} = \frac{25}{2}; \frac{25}{2} \div 20 = \frac{25}{40} = \frac{5}{8} \text{ Ans.}$$

Or, reduce the whole quantity to the lowest denomination, and divide by the number of that denomination which makes one of the higher name to which it is to be reduced. Thus:—

$$12\text{s. } 6\text{d.}$$

$$\underline{12}$$

$$150$$

$$\text{---} = \frac{5}{8}, \text{ Ans.}$$

$$240 = \text{the number of pence in a pound.}$$

37. Reduce 17s. 6d. to the fraction of a pound.
38. Reduce 5s. 6d. to the fraction of a pound.
39. Reduce 7s. 6d. to the fraction of a pound.
40. Reduce $4\frac{1}{2}$ d. to the fraction of a shilling.
41. Reduce $9\frac{3}{4}$ d. to the fraction of a shilling.
42. Reduce 11s. $7\frac{1}{2}$ d. to the fraction of a pound.
43. What part of a dollar is 40 cents?
44. Reduce 56 lb. 8 oz. to the fraction of a cwt.
45. Reduce 65 lb. to the fraction of a ton.
46. Reduce 19 cwt. 28 lb. 12 oz. to the fraction of a ton.
47. Reduce 6 oz. 13 pwt. 8 gr. to lb.
48. Reduce 3 fur. 4 rods, 2 yd. 1 ft. 4 in. to the fraction of a mile.

REDUCTION OF DENOMINATE NUMBERS. 63

49. Reduce 55 days to the fraction of a year.
50. What is the value of .875 of a pound sterling?

Reduce as in who'e numbers, observing to point off the decimals properly. Thus,—

$$\begin{array}{r} \text{£ } .875 \\ \quad 20 \\ \hline 17.500 \text{ shillings.} \\ \quad 12 \\ \hline 6.000 \text{ pence.} \end{array} \qquad \text{Ans. } 17s. 6d.$$

51. Reduce £.625 to its value in shillings and pence.
52. Find the value of £.86875.
53. What is the value of £.58125?
54. Find the value of £.3
55. Find the value of £.6
56. What is the value of £.416?
57. Reduce .79685 of a ton to its value.
58. What is the value of .1778125 of a *cwt.*?
59. What is the value of .89453125 of a *lb.* Avoirdupois?
60. Find the value of .£75 of a pound Troy.
61. Find the value of .97625 of an ounce Troy.
62. Find the value of .79125 of an ounce Apothecaries' weight.
63. What is the value of .176825 of a pound Apothecaries' weight?
64. What is the value of £.475?
65. What is the value of .7 of a *cwt.*?
66. Find the value of .5416 of a shilling sterling.
67. Find the value of .6845 of a *cwt.*
68. Reduce 5s. 10½d. to the decimal of a pound.

Begin with the lowest denomination, and reduce it to the next higher, thus 2 farthings divided by 4 = 4)2 0

.5d., to this prefix the number of pence, and it becomes 10.5d.; divide this by 12 which reduces it to shillings, thus, 12)10.5d.

.875s., to this again prefix the shillings, and reduce the whole to pounds, thus, 20)5.875

£.29375 which is the answer. The work is as follows:

$$\begin{array}{r} 4)2.0 \text{ farthings.} \\ 12)10.500d. \\ 20)5.875s. \\ \hline \text{£.29375} \quad \text{Ans.} \end{array}$$

Reduce the following to the decimal of a pound :

- (69) 17s. 6d. ; (70) 15s. 4½d. ; (71) 13s. 3d. ; (72) 16s. 9¾d. ;
 (73) 10½d. ; (74) 1¾d. ; (75) 9s. ; (76) 1s. 4d. ; (77) 19s., 9d. ;
 (78) 11d.

79. Reduce 3 cwt. 32 lb. to the decimal of a ton.
 80. Reduce 13 cwt. 3 qr. 21 lb. to the decimal of a ton.
 81. Reduce 1 qr. 14 lb. to the decimal of a cwt.
 82. Reduce 37 rods to the decimal of a mile.
 83. Reduce 5 h. 48 m. 50 s. to the decimal of a day.

ADDITION OF DENOMINATE NUMBERS.

RULE.—Write the quantities to be added so that numbers of the same denomination may stand in column. Begin at the right hand, or lowest denomination, add each denomination separately, reducing each sum to the next higher denomination, the number of which carry to the column to which it belongs, and set the remainder, if any, under the column added.

NOTE.—The pupil should carefully study these additions to see that the principle is the same as in addition of simple numbers ; the only difference arising from the varying scale, instead of the uniform scale of 10.

EXERCISES.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
17	11	4½	45	16	3¼	116	12	5½	8	17	2¼
99	19	9	17	11	7½	74	5	9	6	4	4
11	11	11	43	7	10¾	57	18	11¾	1	15	9½
67	15	10½	65	4	9¾	94	8	7½	2	3	10¾
79	19	9	93	9	5½	36	15	3	4	16	8
28	12	1	67	13	2¼	53	2	1¼	9	5	3½
63	8	4½	119	10	8	81	19	8½	11	12	7

5. Add together 13 cwt. 2 qr. 16 lb., 10 cwt. 1 qr. 18 lb., 15 cwt. 3 qr. 27 lb., 18 cwt. 3 qr. 21 lb., 7 cwt. 2 qr. 25 lb.

6. Add together 3 t. 17 cwt. 3 qr. 5 lb., 1 t. 13 cwt. 3 qr. 14 lb., 8 t. 7 cwt. 24 lb., 14 t. 18 cwt. 1 qr. 20 lb. and 5 t. 19 cwt. 3 qr.

7. Find the sum of 4 *t.* 7 *cwt.* 86 *lb.*, 2 *t.* 9 *cwt.* 43 *lb.*, 1 *t.* 8 *cwt.* 90 *lb.*, 1 *t.* 16 *cwt.* 33 *lb.*, 4 *t.* 8 *cwt.* 41 *lb.*, 2 *t.* 17 *cwt.* 89 *lb.*
8. What is the sum of 13 *lb.* 14 *oz.* 10 *dr.*, 15 *lb.* 11 *oz.* 10 *dr.*, 11 *lb.* 4 *oz.* 9 *dr.*, 8 *lb.* 12 *oz.* 13 *dr.*, 15 *lb.* 7 *oz.* 8 *dr.*, 10 *lb.* 13 *oz.* 11 *dr.*, 8 *lb.* 9 *oz.* 6 *dr.*, 4 *lb.* 15 *oz.* 15 *dr.*
9. Add together 3 *lb.* 11 *oz.* 16 *pwt.* 21 *gr.*, 5 *lb.* 8 *oz.* 7 *pwt.* 11 *gr.*, 7 *lb.* 9 *oz.* 18 *pwt.* 23 *gr.*, 11 *lb.* 10 *oz.* 15 *pwt.* 17 *gr.*, 12 *lb.* 7 *oz.* 9 *pwt.* 8 *gr.*, 16 *lb.* 10 *oz.* 11 *pwt.* 22 *gr.* 18 *lb.* 8 *oz.* 19 *pwt.* 18 *gr.*
10. Find the sum of 5 *lb.* 11 *oz.* 7 *dr.* 2 *scr.* 19 *gr.*, 4 *lb.* 10 *oz.* 4 *dr.* 1 *scr.* 7 *gr.*, 3 *lb.* 11 *oz.* 6 *dr.* 2 *scr.* 14 *gr.*, 1 *lb.* 9 *oz.* 3 *dr.* 1 *scr.* 12 *gr.*, 2 *lb.* 4 *oz.* 5 *dr.* 10 *gr.*, 6 *lb.* 7 *oz.* 2 *dr.* 2 *scr.* 9 *gr.*, 2 *lb.* 8 *oz.* 1 *dr.* 1 *scr.* 13 *gr.*
11. What is the sum of 176 *m.* 7 *fur.* 39 *rd.* 5 *yd.*, 85 *m.* 4 *fur.* 20 *rd.* 1 *yd.*, 79 *m.* 6 *fur.* 29 *rd.* 3 *yd.*, 42 *m.* 3 *fur.* 8 *rd.* 2 *yd.*, 67 *m.* 1 *fur.* 11 *rd.* 2 *yd.*, 118 *m.* 3 *fur.* 10 *rd.* 3 *yd.*, 81 *m.* 2 *fur.* 31 *rd.* 1 *yd.*, 79 *m.* 21 *rd.* 2 *yd.*, 18 *m.* 3 *fur.* 33 *rd.* 3 *yd.*?
12. Find the sum of 18 *yd.* 2 *ft.* 11 *in.*, 14 *yd.* 2 *ft.* 7 *in.*, 8 *yd.* 1 *ft.* 10 *in.*, 11 *yd.* 7 *in.*, 7 *yd.* 2 *ft.* 8 *in.*, 16 *yd.* 2 *ft.* 9 *in.*, 8 *yd.* 1 *ft.* 7 *in.*
13. Add together 39 *sq. rd.* 30 *sq. yd.* 8 *sq. ft.* 143 *sq. in.*, 18 *sq. rd.* 11 *sq. yd.* 4 *sq. ft.* 68 *sq. in.*, 24 *sq. rd.* 4 *sq. yd.* 7 *sq. ft.* 118 *sq. in.*, 11 *sq. rd.* 21 *sq. yd.* 2 *sq. ft.* 96 *sq. in.*, 15 *sq. rd.* 27 *sq. yd.* 124 *sq. in.*, 27 *sq. rd.* 6 *sq. yd.* 3 *sq. ft.* 87 *sq. in.*, 19 *sq. rd.* 25 *sq. yd.* 2 *sq. ft.* 38 *sq. in.*
14. What is the area of 7 farms, measuring as follows: the 1st, 79 *a.* 9 *ch.* 9999 *l.*; the 2nd, 117 *a.* 4 *ch.* 3650 *l.*; the 3rd, 47 *a.* 5 *ch.* 941 *l.*; the 4th, 56 *a.* 2 *ch.* 1182 *l.*; the 5th, 27 *a.* 7 *ch.* 2813 *l.*; the 6th, 36 *a.* 1 *ch.* 771 *l.*; the 7th, 84 *a.* 8 *ch.* 1160 *l.*?
15. Find the sum of 35 *b.* 3 *pk.* 1 *gal.* 3 *qrt.* 1 *pt.*, 18 *b.* 2 *pk.* 1 *qrt.* 1 *pt.*, 7 *b.* 1 *pk.* 1 *gal.* 1 *pt.*, 26 *b.* 1 *qrt.*, 18 *b.* 1 *gal.* 1 *pt.*
16. Add together 26 *t.* 17 *cwt.* 3 *qr.* 21 *lb.*, 18 *t.* 11 *cwt.* 19 *lb.* 25 *t.* 15 *cwt.* 1 *qr.* 16 *lb.*, 13 *t.* 17 *cwt.* 2 *qr.* 20 *lb.*, 39 *t.* 4 *cwt.* 1 *qr.* 23 *lb.*, 28 *t.* 16 *cwt.* 3 *qr.* 14 *lb.*
17. What is the sum of 359° 59' 59", 153° 40' 45", 270° 0' 0", 179° 45' 30", 81° 30' 10", 89° 59' 59"?
18. It is required to find the sum of the following periods: 33 *y.* 364 *d.* 23 *h.* 59 *m.* 59 *s.*, 28 *y.* 113 *d.* 11 *h.* 48 *m.* 48 *s.*, 17 *y.* 97 *d.* 12 *h.*, 1 *yr.* 307 *d.* 23 *h.*, 48 *m.* 49 *s.*, 12 *yr.* 114 *d.*

19. Add together 12 yd. 2 ft. 9 in., 16 yd. 1 ft. 11 in., 28 yd. 8 in., 37 yd. 6 in.

When it is required to find the sum of several fractions of different denominations.

RULE.—Reduce the fractions to the same name, add them and find the value of their sum, or,

Find the values of the several fractions separately, and add these values.

EXAMPLE.—Add together $\frac{5}{8}$ of a pound and $\frac{1}{4}$ of a shilling.

$$\pounds \frac{5 \times 20}{8} = \frac{25}{2} s.$$

$$\text{or, } \pounds \frac{5 \times 20}{8} = \frac{25}{2} s. = 12 \frac{1}{2} s.$$

$$\frac{25}{2} s. + \frac{5}{6} s. = \frac{80}{6} s. = 13 s. 4 d. \text{ Ans. } \quad \frac{5}{6} s. \times 12 = \frac{0 \ 10}{12 s. 4 d. \text{ Ans.}}$$

20. Add together $\pounds \frac{7}{16}$ and $\frac{5}{8} s.$

21. Add together $\pounds \frac{3}{12}$, $\frac{7}{8} s.$ $\frac{3}{4} d.$

22. Add $\frac{1}{4}$ of a ton to $\frac{1}{12}$ of a cwt.

23. Add together $\frac{1}{8}$ of a m., $\frac{1}{6}$ of a fur., and $\frac{1}{8} rd.$

24. Add together $\frac{1}{16}$ of a cwt., $\frac{5}{8}$ of a t., and $\frac{3}{4}$ of a lb.

25. Add together $\pounds \frac{9}{16}$ and .875 of a s.

When the fractions are decimal, reduce the higher denominations to the lower, and add them in their decimal form.

EXAMPLE.—Find the sum of .79685 of a t., and .1778125 of a cwt.

$$\begin{array}{r} .79685 \text{ t.} \\ 20 \\ \hline 15.93700 \text{ cwt.} \\ .1778125 \\ \hline 16.1148125 \text{ sum in cwt.} \end{array}$$

The decimal part of which reduced to lb. = 11.48125 lb.

$$\begin{array}{r} 16 \\ \hline 7.70000 \text{ oz.} \\ 16 \\ \hline 11.2 \text{ dr.} \end{array}$$

16 cwt. 11 lb. 7 oz. 11.2 dr. Ans.

SUBTRACTION OF DENOMINATE NUMBERS. 67

26. Find the sum of .675 of a *lb.* Troy, and .97625 of an *oz.* Troy.
27. What is the sum of £.790625, .5416 *s.* and .75 *d.*
28. What is the sum of £.79375 and .375 *s.*?
29. Find the sum of .896875 *t.*, .875 *cwt.* and .25 *qr.* (British Weight.)
30. Find the sum of .393 *t.*, .9 *cwt.* and .5625 *lb.* (Canadian Weight.)

SUBTRACTION OF DENOMINATE NUMBERS.

RULE.—Write the smaller quantity under the larger, setting numbers of the same denomination under each other.

Begin at the right, and take the numbers in the subtrahend from those immediately above them in the minuend.

When any number in the subtrahend exceeds that of the same denomination in the minuend, add to the number in the minuend, as many of that denomination as make one of the next higher, subtract the number in the subtrahend from the sum, and carry one to the next denomination as you proceed; or consider the next number in the minuend diminished by 1.

EXERCISES.

	(1.)			(2)			(3)		
	£	s.	d.	t.	cwt.	lb.	m.	fur.	rd.
From	1573	11	4½	47	17	43	1407	1	16
Take	976	15	10½	29	18	97	161	1	20

4. A farmer possessed 1279 *a.* 2 *roods* 21 *rd.* of land, and by his will left 789 *a.* 3 *roods* 36 *rd.* to the elder of his two sons: how much was left for the younger?

5. The latitude of London, England, is 51° 30' 49" N., and that of Gibraltar 36° 6' 30" N., how many degrees is Gibraltar south of London?

6. The earth performs a revolution round the sun in about 365 *d.* 5 *h.* 48 *m.* 50 *s.*, and the planet Jupiter in about 4332 *d.* 14 *h.* 26 *m.* 55 *s.*, how much longer does it take Jupiter to perform a revolution than the earth?

7. What is the difference between 21 h. 19 m. 24 s., and 15 h. 37 m. 45 s.?

8. How many months and days from August 29th, 1872, to April 15th, 1873?

9. How many months and days from December 3rd, 1872, to October 2nd, 1873?

10. What is the difference in time between March 3rd, 5 h. 36 m. 42 s., and March 2nd, 21 h. 52 m. 47 s.?

11. From $107^{\circ} 40' 33''$ take $69^{\circ} 50' 19''$.

12. A man who owes you £19 11 s. $5\frac{1}{2}$ d. gives you £20, how much have you to give him back?

13. From 16 cwt. 3 qr. 12 lb. take 11 cwt. 1 qr. 22 lb.

14. From 18 cwt. 1 qr. 15 lb. take 12 cwt. 2 qr. 27 lb.

15. From £42 7 s. 4 d. take £27 10 s. 8 d.

16. From £56 16 s. $7\frac{1}{2}$ d. take £49 12 s. 10 d.

17. From £114 0 s. $8\frac{1}{4}$ d. take £19 19 s. $5\frac{1}{2}$ d.

18. From £34 5 s. take £27 13 s. $1\frac{1}{2}$ d.

When it is required to find the difference between two fractions of different denominations.

RULE.—Reduce one to the same denomination as the other, perform the subtraction required, and find the value of the resulting fraction; or,

Find the value of each fraction, and subtract one value from the other.

EXAMPLE.—What is the difference between $\frac{9}{11}$ of a mile and $\frac{5}{7}$ of a furlong?

$$\frac{9}{11}m. \times 8 = \frac{72}{11}f.$$

$$\frac{72}{11}f. - \frac{5}{7}f. = \frac{449}{77}f. = 5f. 33rd. 1yd. 1ft. 0\frac{1}{2}in. \text{ Ans.}$$

Or,

$$\frac{9}{11}m. \times 8 = \frac{72}{11}f. = 6f. 21rd. 4yd. 1ft. 6in.$$

$$\frac{5}{7}f. \times 40 = \frac{200}{7}rd. = \frac{28rd. 3yd. 0ft. 5\frac{1}{2}in.}{5f. 33rd. 1yd. 1ft. 0\frac{1}{2}in. \text{ Ans.}}$$

MULTIPLICATION OF DENOMINATE NUMBERS. 69

19. From $\frac{1}{4}$ of a ton take $\frac{1}{8}$ of a *cwt*.
20. What is the difference between $\frac{3}{4}$ of a pound Troy and $\frac{1}{16}$ of an ounce Troy?
21. Find the difference between $\frac{1}{4}$ of a bushel and $\frac{1}{8}$ of a peck.
22. What is the difference between $\frac{1}{8}$ of a pound and $\frac{1}{16}$ of a shilling.
23. From $\pounds \frac{5}{8}$ take $\frac{1}{16}$ s.
24. From $\pounds \frac{1}{4}$ take £.4625.
25. Find the difference between £.76825 and .925 s.
26. From .690484375 of a ton take .87796875 of a *cwt*.
27. Find the difference between .875 of a quart and .90625 of a gallon.
28. What is the difference between $\frac{5}{8}$ of a ton and $\frac{7}{16}$ of a *cwt*, by the British table?

MULTIPLICATION of DENOMINATE NUMBERS.

RULE.—Set the multiplier under the lowest denomination of the multiplicand, and multiply each denomination in succession, observing to reduce each product to the next higher denomination. Write the remainder, if any, from each reduction, and carry the quotient to the next product.

EXAMPLE.—Multiply £27 17 s. $5\frac{1}{4}$ d. by 6.

£ s. d. 27 17 $5\frac{1}{4}$ 6 ----- 167 4 $7\frac{1}{2}$	Six times 1 far. are 6 far., which are = 1 d. 2 far. Set down the 2 far. and carry the 1 penny to the product of the pence. Six times 5 d. are 30 d., and 1 d. added makes 31 d., which are = 2 s. 7 d. Set down the 7 d. in the pence column, and carry the 2 s. to the product of the shillings. Six times 17 s. are 102 s., and 2 s. added make 104 s. which are = £5 and 4 s. Set down the 4 s. in the shillings column, and carry the £5 to the product of the pounds. Six times £27 are £162, and £5 added make £167, which set in the pounds column.
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EXERCISES.

(1.)	(2.)	(3.)
£ s. d. 64 11 $9\frac{1}{2}$ 3 -----	£ s. d. 78 5 $11\frac{3}{4}$ 9 -----	£ s. d. 147 12 $1\frac{1}{4}$ 12 -----

DENOMINATE NUMBERS.

(4.)			(5.)			(6.)					
<i>t.</i>	<i>cwt.</i>	<i>lb.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>lb.</i>	<i>oz.</i>	<i>pwt.</i>	<i>gr.</i>		
5	17	29	17	11	13	7	4	15	21		
		5			6				7		
(7.)					(8.)		(9.)				
<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>scr.</i>	<i>gr.</i>	<i>m.</i>	<i>fur.</i>	<i>rd.</i>	<i>bush.</i>	<i>pk.</i>	<i>qrt.</i>	<i>pt.</i>
3	7	6	1	15	5	7	15	9	1	3	1
				11			8				10
(10.)			(11.)			(12.)					
<i>h.</i>	<i>m.</i>	<i>s.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>			
5	31	42	7	12	55	4	56	28			
		4			7			5			

When the multiplier is more than 12, it is usual to multiply by factors. Thus,

EXAMPLE—1. Multiply $\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 24 \quad 18 \quad 10\frac{3}{4} \end{array}$ by 28. $28 = 7 \times 4$.

$$\begin{array}{r} 174 \quad 12 \quad 3\frac{1}{4} \\ \quad \quad \quad 4 \\ \hline 698 \quad 9 \quad 1 \end{array}$$
 product by 28.

EXAMPLE—2. Multiply 16 *t.* 12 *cwt.* 76 *lb.* by 243.

t. *cwt.* *lb.*

$$16 \quad 12 \quad 76 \times 3 (10 \times 10 \times 2) + (10 \times 4) + 3 = 243$$

$$\begin{array}{r} 10 \\ \hline \text{Product by } 10 = 166 \quad 7 \quad 60 \times 4 \\ \quad \quad \quad 10 \\ \hline \text{Product by } 100 = 1663 \quad 16 \quad 00 \\ \quad \quad \quad 2 \\ \hline \text{Product by } 200 = 3327 \quad 12 \quad 00 \\ \text{Product by } 40 = 665 \quad 10 \quad 40 \\ \text{Product by } 3 = 49 \quad 18 \quad 28 \\ \hline \text{Product by } 243 = 4043 \quad 0 \quad 68 \text{ Ans.} \end{array}$$

13. Multiply £18 13 s. 7 d. by 15.
14. Multiply £45 19 s. 10½ d. by 21.
15. Multiply £49 7 s. 5½ d. by 29.
16. Multiply 18 t. 12 cwt. 61 lb. by 84.
17. Multiply 16 cwt. 3 qr. 22 lb. by 38.
18. Multiply 11 yd. 2 ft. 7 in. by 150.
19. Multiply 49 lb. 11 oz. 12 dr. by 67.
20. Bought 7 loads of hay, each weighing 1 t. 3 cwt. 87 lb., what was the weight of the whole?
21. If a man can reap 3 a. 35 rd. per day, how much can he reap in 30 days?
22. If a man saw a cord of wood in 8 h. 45 m. 50 s., how long will he be sawing 11 cords?
23. If 12 gal. 3 qrt. 1 pt. of molasses be used in a hotel in a week, how much would be used in a year at the same rate?
24. If 13 wagons carry 3 t. 15 cwt. 40 lb. each, how much do they all carry?

DIVISION OF DENOMINATE NUMBERS.

RULE.—Begin with the highest denomination, and divide each in succession, writing the quotient beneath. When a remainder occurs, reduce it to the next lower denomination, add in the number of that denomination, and use the sum as the next dividend. So proceed to the end.

EXAMPLE.—Divide £47 13 s. 8½ d. by 7.

£	s.	d.	
7)47	13	8½	
6	16	2¾	Ans.

7 into 47, 6 times and £5 over; write 6, and reduce £5 to shillings, thus, 5 × 20 = 100, add 13 = 113; 7 into 113, 16 times and 1 shilling over; reduce the 1 shilling to pence, and add s = 20 pence; 7 into 20, twice and 6 pence over; reduce 6 pence to farthings, and add 2 = 26; divide by 7 = 3 times and 5 over, which divided by 7 = ¾.

EXERCISES.

1. Divide £476 19 s. 5 d. by 5.
2. What is the ½ of £927 4 s. 11½ d.

3. Find the $\frac{1}{3}$ of £1728 1 s. 3 $\frac{1}{2}$ d.
4. Find the $\frac{1}{12}$ of 27 t. 16 cwt. 56 lb.
5. Find the $\frac{1}{17}$ of 147 lb. 14 oz. 6 dr.
6. What is the $\frac{1}{4}$ of 62 lb. 5 oz. 16 pwt. 1 gr.?
7. Find $\frac{1}{5}$ of 17 cwt. 1 qr. 12 lb.
8. Divide £47 13 s. 9 d. by 12.
9. Divide £58 16 s. 10 $\frac{1}{2}$ d. by 7.
10. Divide £137 17 s. 7 d. by 11.

When the divisor is more than 12 we may either divide successively by its factors, or employ the process of long division.

EXAMPLE.—Divide £7629 14 s. 2 d. by 28.

FIRST METHOD.

$$28 = 4 \times 7.$$

$$\begin{array}{r} 4 \overline{) 7629 \ 14 \ 2} \\ \underline{1907} \quad 8 \ 6\frac{1}{2} \\ 272 \quad 9 \ 9\frac{1}{2} \text{ Ans.} \end{array}$$

SECOND METHOD.

£	s.	d.	£	s.	d.	
28)	7629	14	2(	272	9	9 $\frac{1}{2}$ Ans.
	56					
	202					
	196					
	69					
	56					
	13					
	20					
	274					
	252					
	22					
	12					
	266					
	252					
	14					
	4					
	56					
	56					

11. Divide 1564 t. 19 cwt. 24 lb. by 84.
12. Divide 1 t. 13 cwt. 32 lb. 3 oz. 4 dr. by 67.
13. 7 loads of hay weighed 8 t. 3 cwt. 87 lb. in the aggregate, what was the weight of each load on an average?
14. A silversmith made half-a-dozen spoons, weighing 2 lb. 8 oz. 10 pwt., what was the weight of each?

15. If 45 wagons carry 685 *bush.* 2 *pk.* 4 *qrt.*, how much does each carry on an equal distribution?
16. If a steamer occupies 48 *d.* 17 *h.* 40 *m.* in making 121 trips, what is the average time?
17. If 98 *bush.* 3 *pk.* 2 *qrt.* of grain can be packed in 37 equal-sized barrels, how much will there be in each?
18. In a coal mine 1459 *t.* 4 *cwt.* 3 *qr.* 14 *lb.* were raised in 97 days, how much was that per day on an average?
19. If \$15.50 be the value of 1 *lb.* of silver, what will be the weight of \$500,000 worth?
20. If 13 hogsheads of sugar weigh 6 *t.* 8 *cwt.* 1 *qr.* 14 *lb.*, what is the weight of each?
21. What is the twenty-third part 137 *lb.* 9 *oz.* 18 *part.* 22 *gr.*?
22. A shipment of sugar consisted of 8003 *t.* 8 *cwt.* 1 *qr.* 0 *lb.* 10 *oz.* net weight, it was to be shared equally by 451 grocers, how much did each get?
23. If a horse runs 174 *m.* 26 *rd.* in 14 hours, what is his speed per hour?
24. A farmer divided his farm containing 322 *a.* 8 *sq. ch.* equally among his seven sons and six sons-in-law, what was the share of each?

THE CENTAL.

In some markets grain is bought and sold by the 100 *lb.* or cental. Railway freight tariffs are sometimes reckoned in the same way.

The following rules show how to find what price per cental corresponds to a given price per bushel, and *vice versa*.

To find the price per cental to correspond with a given price per bushel.

RULE.—Multiply the given price per bushel by 100, and divide the product by the weight of a bushel in pounds.

EXAMPLE.—What is the price per cental of wheat, when the price per bushel is \$2.10?

$$\begin{array}{r} 6,0 \overline{)210.00} \\ \underline{3.50} \text{ price per cental.} \end{array}$$

EXERCISES.

1. What is the price per cental of wheat, when the rate per bushel is \$1.80?
2. When clover seed is \$4.20 per bushel, what should be the price per cental?
3. When Indian corn is worth \$1.12 per bushel, what should be the price per cental?
4. When rye is \$1.40 per bushel, what should be the price per cental?
5. When oats are 45 cents per bushel, what is the price per cental?
6. When potatoes are 90 cents per bushel, what is the corresponding price per cental?

To find the price per bushel to correspond with a given price per cental.

RULE.—Multiply the given price per cental by the number of pounds to the bushel of the commodity mentioned, and divide the product by 100.

EXAMPLE.—If wheat is worth \$3.25 per cental, what should be the price per bushel?

$$\begin{array}{r}
 \$3.25 \\
 \times 60 \\
 \hline
 195.00 \\
 \hline
 1.95 \text{ price per bushel.}
 \end{array}$$

EXERCISES.

1. When oats are \$1.30 per cental, what should they be per bushel?
2. If Timothy seed sells for \$10 per cental, what is the price per bushel?
3. When clover seed is \$12 per cental, what is the price per bushel?
4. When rye is \$2.25 per cental, what is the price per bushel?

FOREIGN MONIES OF ACCOUNT AND THEIR
VALUES IN CANADIAN CURRENCY.

COUNTRY.	MONETARY UNIT.	VALUE IN CANADIAN CURRENCY
Austria	Florin of 100 kreutzers.....	.40,7
Belgium	*Franc of 100 centimes.....	.19,3
Bolivia	†Boliviano of 100 centavos ..	.82,3
Brazil	Milreis of 1000 reis.....	.54,6
Chili	Peso of 100 centavos	.91,2
China	Tael	\$1.35
Cuba	Peso of 100 centavos	.93,2
Denmark	‡Crown of 100 öre	.26,8
Ecuador	†Peso of 100 centavos	.82,3
Egypt	Piaster of 40 paras	.04,9
France	*Franc of 100 centimes	.19,3
Great Britain	Pound Sterling	4.86 $\frac{2}{3}$
Greece	*Drachma of 100 lepta	.19,3
German Empire	Mark of 100 pfennige	.23,8
India	Rupce of 16 annas §	.39
Italy	*Lira of 100 centesimi	.19,3
Japan	Yen of 100 sen	.88,8
Liberia	Dollar of 100 cents	1.00
Manilla	Dollar	1.00
Mexico	Dollar of 100 centavos	.89,4
Netherlands	Florin of 100 cents	.40,2
Norway	‡Crown of 100 öre	.26,8
Peru	†Sol of 100 centavos	.82,3
Porto Rico	Peso or Doll. of 100 centavos	.92,5
Portugal	Milreis of 1000 reis	1.08
Russia	Rouble of 100 copecks	.65,8
Sandwich Islands	Dollar of 100 cents	1.00
Spain	*Peseta of 100 centimes	.19,3
Sweden	‡Crown of 100 öre	.26,8
Switzerland	*Franc of 100 centimes	.19,3
Tripoli	Mahbub of 20 piasters	.74,3
Turkey	Piaster of 40 paras	.04,4
United States	Dollar of 100 cents	1.00
U. S. of Columbia	†Peso of 100 centavos	.82,3
Venezuela	*Bolivar	.19,3

* The franc of France, Belgium and Switzerland, the peseta of Spain, the drachma of Greece, the lira of Italy, and the bolivar of Venezuela have the same value.

† The peso of Ecuador and United States of Columbia, the boliviano of Bolivia, and the sol of Peru have the same value.

‡ The crowns of Norway, Sweden and Denmark have the same value.

§ The anna contains 12 pies.

EXERCISES.

1. The longitude of Dublin is about $7^{\circ} 20'$ W., and of St. John's, Newfoundland, about $52^{\circ} 41'$ W.; what is the difference of time?

2. What is the difference of time between St. John's, Newfoundland, in longitude $52^{\circ} 41'$ W. and Toronto, Ontario, in longitude $79^{\circ} 30'$ W.

3. What is the difference of time between Halifax, N. S. and St. John, N. B., the longitude of Halifax being $63^{\circ} 34'$ W., and of St. John, $66^{\circ} 0'$ W.?

Since the apparent motion of the sun is toward the West, of two places that which is farther East will have the sun on its meridian first, and consequently its time will be the faster.

4. London, England, is nearly on the first meridian, that is, its longitude is nearly nothing, what time is it at Halifax in longitude $63^{\circ} 34'$ W., when it is noon at London?

5. What time should it be in Montreal in longitude $73^{\circ} 44'$ W., when it is noon at Fredericton, N. B., in longitude $66^{\circ} 43'$ W.?

6. What time should it be in Pictou, N. S. when the noon gun sounds at Halifax—longitude of Pictou $62^{\circ} 42'$ W., and that of Halifax $63^{\circ} 34'$ W.?

7. Yarmouth, N. S. is in about $66^{\circ} 7'$ W. longitude, and Quebec in about $71^{\circ} 24'$ W. longitude; what time should it be at Yarmouth when it is noon at Quebec?

8. Greenwich, England, is on the first meridian; what time should be shown by a ship's chronometer, showing Greenwich time, when the ship is in longitude 74° W., and her correct time 9 h. 30 m. A.M.

Given the difference of time between two places, to find the difference of longitude.

This is the converse of the last case.

RULE.—Multiply the difference of time by 15; or, multiply the hours by 60, add in the minutes, and divide the sum by 4.

EXAMPLE.—The difference of time between two places is found to be 3 *h.* 45 *m.* 52 *s.*; required the difference of longitude.

FIRST METHOD.			SECOND METHOD.		
<i>h.</i>	<i>m.</i>	<i>s.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>
3	45	52	3	45	52
		3	60		
11	17	36	4)225	52	
		5			
56° 28' 00" Ans.			56° 28' Ans.		

EXERCISES.

1. The difference of time between Halifax, N.S. and Fredericton, N. B. is 12 *m.* 36 *s.*, required the difference of longitude.
2. When it is noon at Yarmouth, N. S., it is 11 *h.* 43 *m.* 24 *s.* A.M. at Portland, Me., what is the difference of longitude?
3. When it is noon at Greenwich, England, it is 7 *h.* 36 *m.* A.M., at St. John, N. B., what is the longitude of St. John?
4. What is the longitude of Montreal, if, when it is noon at Greenwich, it is 7 *h.* 5 *m.* 4 *s.* A.M., at Montreal?
5. What is the longitude of a ship whose correct time is found to be 5 *h.* 35 *m.* 40 *s.* faster than the time at Greenwich?
6. What is the longitude of a ship whose correct time is 8 *h.* 43 *m.* slower than the time at Greenwich?

ALIUOT PARTS.

An **Aliquot Part** of a number or quantity is a factor contained in it an integral number of times, and is therefore always expressed by a fraction whose numerator is 1, and whose denominator is a whole number.

Hence, for example, when the price of any given quantity of a commodity is known, the price of any portion of such quantity, which is an aliquot part of it, may be readily found by taking the same part of the price of the given quantity; and this can always be done by simply dividing by the denominator of the fraction expressing the aliquot part.

EXAMPLE.—1. What is the price of 65 *lb.* of beef @ \$9 per *cwt.*

OPERATION.

50 lb. = $\frac{1}{2}$ of 1 cwt. 2) \$9.00

10 lb. = $\frac{1}{5}$ of 50 lb. 5) 4.50 = $\frac{1}{5}$ of \$9.00 = price of 50 lb.

5 lb. = $\frac{1}{2}$ of 10 lb. 2) .90 = $\frac{1}{2}$ of 4.50 = " 10 lb.

.45 = $\frac{1}{2}$ of .90 = " 5 lb.

Sum, \$5.85 = price of 65 lb. Ans.

EXAMPLE.—2. What is the price of 6 cwt. 3 qr. 23 lb. @ \$17.60 per ton?

OPERATION.

5 cwt. = $\frac{1}{4}$ of 1 t. 4) \$17.60

1 cwt. = $\frac{1}{5}$ of 5 cwt. 5) 4.40 = $\frac{1}{5}$ of \$17.60 = price of 5 cwt.

2 qr. = $\frac{1}{2}$ of 1 cwt. 2) .88 = $\frac{1}{2}$ of 4.40 = " 1 "

1 qr. = $\frac{1}{2}$ of 2 qr. 2) .44 = $\frac{1}{2}$ of .88 = " 2 qr.

14 lb. = $\frac{1}{2}$ of 1 qr. 2) .22 = $\frac{1}{2}$ of .44 = " 1 "

7 lb. = $\frac{1}{2}$ of 14 lb. 2) .11 = $\frac{1}{2}$ of .22 = " 14 lb.

2 lb. = $\frac{1}{7}$ of 14 lb. 7) .055 = $\frac{1}{7}$ of .11 = " 7 "

.016 = $\frac{1}{4}$ of .064 = " 2 "

Sum, \$6.12 = price of 6 cwt. 3 qr. 23 lb.

EXAMPLE.—3. What will 156 yd. of cloth cost @ $3\frac{1}{2}$ per yd.

OPERATION.

2 s. = $\frac{1}{10}$ of £1 10) £156 = price @ £1 per yd.

1 s. = $\frac{1}{2}$ of 2 s. 2) 15 12 s. = $\frac{1}{10}$ of 156 = price @ 2 s. per yd.

4 d. = $\frac{1}{3}$ of 1 s. 3) 7 16 = $\frac{1}{3}$ of 15 12 = " 1 s. "

$\frac{1}{2}$ d. = $\frac{1}{6}$ of 4 d. 8) 2 12 = $\frac{1}{6}$ of 7 16 = " 4 d. "

0 6 6 = $\frac{1}{8}$ of 2 12 = " $\frac{1}{2}$ d. "

Sum, £26 6 6 = price @ 3 s. $4\frac{1}{2}$ d. "

TABLES OF ALIQUOT PARTS.

The following are the principal parts of \$1, expressed in cents:

50 cents = $\frac{1}{2}$.	16 $\frac{2}{3}$ cents = $\frac{1}{6}$.
25 " = $\frac{1}{4}$.	8 $\frac{1}{3}$ " = $\frac{1}{12}$.
12 $\frac{1}{2}$ " = $\frac{1}{8}$.	37 $\frac{1}{2}$ " = $\frac{3}{8}$ = $\frac{1}{4}$ + $\frac{1}{2}$ of $\frac{1}{4}$.
10 " = $\frac{1}{10}$.	62 $\frac{1}{2}$ " = $\frac{5}{8}$ = $\frac{1}{2}$ + $\frac{1}{4}$ of $\frac{1}{2}$.
20 " = $\frac{1}{5}$.	75 " = $\frac{3}{4}$ = $\frac{1}{2}$ + $\frac{1}{2}$ of $\frac{1}{2}$.
33 $\frac{1}{3}$ " = $\frac{1}{3}$.	87 $\frac{1}{2}$ " = $\frac{7}{8}$ = $\frac{1}{2}$ + $\frac{1}{2}$ of $\frac{1}{2}$ + $\frac{1}{2}$ of $\frac{1}{4}$.

NOTE.—If the cents in the above table be called pounds avoirdupois, they will represent the same parts of a cwt. or cental.

The following are the principal parts of a ton expressed in pounds:

1000 lb. = $\frac{1}{2}$.	100 lb. = $\frac{1}{20}$.
500 " = $\frac{1}{4}$.	40 " = $\frac{1}{50}$.
250 " = $\frac{1}{8}$.	25 " = $\frac{1}{80}$.
125 " = $\frac{1}{16}$.	750 " = $\frac{3}{8} = \frac{1}{4} + \frac{1}{2}$ of $\frac{1}{4}$.
400 " = $\frac{1}{5}$.	1250 " = $\frac{5}{8} = \frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2}$.
200 " = $\frac{1}{10}$.	1750 " = $\frac{7}{8} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2} + \frac{1}{2}$ of $\frac{1}{4}$.

The following are the principal parts of £1, expressed in shillings and pence:

10/ = $\frac{1}{2}$.	3/4 = $\frac{1}{8}$.
5/ = $\frac{1}{4}$.	1/8 = $\frac{1}{16}$.
2/6 = $\frac{1}{8}$.	7/6 = $\frac{3}{8} = \frac{1}{4} + \frac{1}{2}$ of $\frac{1}{4}$.
1/3 = $\frac{1}{12}$ or $\frac{1}{2}$ of 2/6.	12/6 = $\frac{5}{8} = \frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2}$.
6/8 = $\frac{1}{3}$.	15/ = $\frac{3}{4} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2}$.
1/ = $\frac{1}{20}$.	17/6 = $\frac{7}{8} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2} + \frac{1}{2}$ of $\frac{1}{4}$.
2/ = $\frac{1}{10}$.	3/9 = $\frac{1}{3} = \frac{1}{8} + \frac{1}{2}$ of $\frac{1}{8}$.
4/ = $\frac{1}{5}$.	6/3 = $\frac{1}{3} = \frac{1}{4} + \frac{1}{4}$ of $\frac{1}{4}$.
	8/9 = $\frac{7}{6} = \frac{1}{4} + \frac{1}{2}$ of $\frac{1}{4} + \frac{1}{2}$ of $\frac{1}{8}$.
	11/3 = $\frac{9}{8} = \frac{1}{2} + \frac{1}{8}$ of $\frac{1}{2}$.
	13/9 = $\frac{11}{6} = \frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2} + \frac{1}{2}$ of $\frac{1}{8}$.
	16/3 = $\frac{13}{8} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2} + \frac{1}{4}$ of $\frac{1}{4}$.
	18/9 = $\frac{15}{8} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2} + \frac{1}{2}$ of $\frac{1}{4} + \frac{1}{2}$ of $\frac{1}{8}$.

The following are the principal parts of a shilling, expressed in pence:

6 d. = $\frac{1}{2}$.	4½ d. = $\frac{3}{8} = \frac{1}{4} + \frac{1}{2}$ of $\frac{1}{4}$.
3 " = $\frac{1}{4}$.	7½ " = $\frac{5}{8} = \frac{1}{2} + \frac{1}{4}$ of $\frac{1}{2}$.
1½ " = $\frac{1}{8}$.	9 " = $\frac{3}{4} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2}$.
¾ " = $\frac{1}{16}$.	10½ " = $\frac{7}{8} = \frac{1}{2} + \frac{1}{2}$ of $\frac{1}{2} + \frac{1}{2}$ of $\frac{1}{4}$.
1 " = $\frac{1}{12}$.	
2 " = $\frac{1}{6}$.	
4 " = $\frac{1}{3}$.	

EXERCISES.

Find the prices of the following quantities at the rates given:

1. 46 lb. @ \$1.80 per cwt.
2. 37½ lb. @ \$4.50 per cwt.

3. 30 lb. @ \$3.75 per cwt.	19. 77 lb. @ \$4.40 per cwt.
4. 75 " \$7.20 "	20. 43 " \$5.25 "
5. 62½ " \$6.80 "	21. 250 " \$14.00 per ton.
6. 87½ " \$5.50 "	22. 750 " \$12.00 "
7. 15 " \$5.90 "	23. 1250 " \$13.50 "
8. 17½ " \$2.40 "	24. 1500 " \$12.40 "
9. 27½ " \$2.68 "	25. 1750 " \$15.20 "
10. 12½ " \$7.60 "	26. 1875 " \$16.40 "
11. 35 " \$3.10 "	27. 1900 " \$25.30 "
12. 45 " \$1.72 "	28. 450 " \$10.10 "
13. 55 " \$1.84 "	29. 1230 " \$15.90 "
14. 65 " \$8.40 "	30. 720 " \$21.70 "
15. 75 " \$7.24 "	31. 1640 " \$29.85 "
16. 85 " \$16.25 "	32. 1265 " \$9.84 "
17. 95 " \$10.20 "	33. 1715 " \$11.80 "
18. 84 " \$9.00 "	34. 1943 " \$21.00 "
35. 2 qr. 14 lb. @ £1 12 8 per cwt.	
36. 1 qr. 16 lb. @ £2 6 9 "	
37. 3 qr. 21 lb. @ £1 14 0 "	
38. 2 qr. 25 lb. @ £0 18 6 "	
39. 0 qr. 23 lb. @ £5 13 9 "	
40. 3 qr. 9 lb. @ £3 1 10½ "	
41. 12 cwt. 2 qr. 14 lb. @ £4 10 per ton.	
42. 9 cwt. 1 qr. 7 lb. @ £6 15 "	
43. 15 cwt. 3 qr. 5 lb. @ £3 19 4 "	
44. 17 cwt. 2 qr. 12 lb. @ £5 5 0 "	
45. 10 cwt. 0 qr. 18 lb. @ £14 17 7 "	
46. 14 cwt. 1 qr. 10 lb. @ £0 13 6 "	
47. 3 cwt. 0 qr. 19 lb. @ £2 5 0 "	
48. 16 cwt. 3 qr. 27 lb. @ £3 15 0 "	
49. 11 cwt. 2 qr. 18 lb. @ £4 6 0 "	
50. 13 cwt. 1 qr. 9 lb. @ £5 8 4 "	
51. 360 articles @ 10/ each.	58. 410 articles @ 6/8 each.
52. 436 " " 5/ "	59. 2463 " " 18/9 "
53. 580 " " 15/ "	60. 247 " " 13/4 "
54. 141 " " 2/6 "	61. 1420 " " 3/4 "
55. 396 " " 1/3 "	62. 860 " " 5/6 "
56. 1224 " " 12/6 "	63. 1000 " " 11/ "
57. 1840 " " 17/6 "	64. 1400 " " 1/6 "

65.	1725	articles @ 6 d. each.
66.	2100	" " 3 d. "
67.	2250	" " 9 d. "
68.	300	" " $1\frac{1}{2}$ d. "
69.	1300	" " $4\frac{1}{2}$ d. "
70.	624	" " $7\frac{1}{2}$ d. "
71.	1260	" " $10\frac{1}{2}$ d. "
72.	720	" " $1\frac{1}{4}$ "
73.	3627	" " $3\frac{1}{9}$ "
74.	1220	" " $6\frac{1}{3}$ "
75.	843	" " $7\frac{1}{6}$ "
76.	927	" " $13\frac{1}{9}$ "
77.	145	" " $16\frac{1}{6}$ "
78.	490	" " $19\frac{1}{9}$ "
79.	49	" " $14\frac{1}{5}$ "
80.	276	" " $15\frac{1}{10}$ "
81.	1138	" " $14\frac{1}{6}$ "
82.	330	" " $3\frac{1}{10}\frac{1}{2}$ "
83.	660	" " $2\frac{1}{8}$ "
84.	148	" " $4\frac{1}{7}\frac{1}{2}$ "
85.	284	" " $7\frac{1}{3}$ "
86.	428	" " $8\frac{1}{4}$ "
87.	75	" " $9\frac{1}{8}$ "
88.	235	" " $11\frac{1}{3}$ "
89.	240	" " $11\frac{1}{9}$ "
90.	725	" " $12\frac{1}{4}\frac{1}{2}$ "
91.	16 cwt. 3 qr. 10 lb.	@ £1 10 6 per ton.
92.	7 cwt. 2 qr. 16 lb.	@ £2 12 6 "
93.	1760 lb.	@ \$14.50 per ton.
94.	1184	" \$16.00 "
95.	1826	" \$13.80 "
96.	64	" \$5.70 per cwt.
97.	76	" \$8.10 "
98.	35	" \$12.40 "
99.	57 $\frac{1}{2}$	" \$11.20 "
100.	48	" \$4.00 "

PERCENTAGE.

Percentage is a term generally applied to any computation made by the hundred.

It is also used to designate a portion of any number or quantity estimated by the hundred.

The term is derived from the Latin words "*per centum*," usually abbreviated into per cent., (and often written %) which means by or on the hundred.

Rates of Commissions, Discounts, Interest, Insurance, Duties, Exchange, Profits and Losses, and many other allowances are estimated by the hundred, and percentage is therefore a subject of very extensive application in business.

Three elements enter into calculations by percentage which are expressed by the terms, the **Base**, the **Rate**, and the **Percentage**.

The **Base** is the number or quantity on which the percentage is reckoned.

The **Rate** is the allowance on every 100 of the base.

The **Percentage** is that number or quantity which the allowance expressed by the rate amounts to when applied to the base.

In cases where the percentage is added to the base, the sum is called the **amount**.

In cases where the percentage is subtracted from the base, the difference is known as the **net**, that is, the net price, net cost, net proceeds, &c.

EXAMPLE.—1. If I borrow \$500 at 8 per cent. per annum, I agree to pay for the use of the money for a year \$8 for every \$100; and as there are 5 hundreds, I will pay 5 times \$8, or \$40. The \$500 is the base, 8 expresses the rate, and \$40 is the percentage. Now if the base \$500, and the percentage \$40, be added, the sum \$540 is the amount.

EXAMPLE.—2. If I am selling pianos at a nominal price of \$800, but agree to allow a customer a discount of 10 per cent., I make a reduction of \$80 on every \$800 of the price named, that



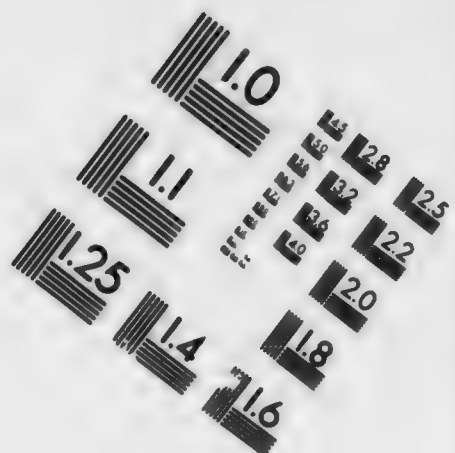
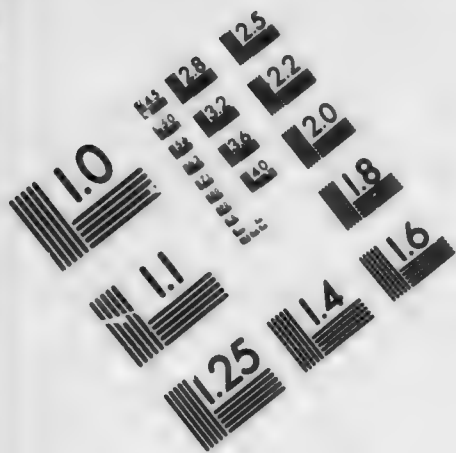
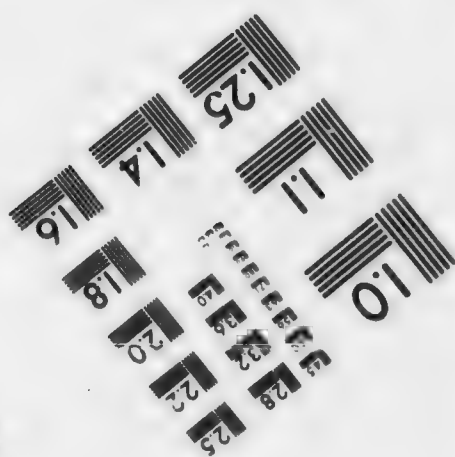
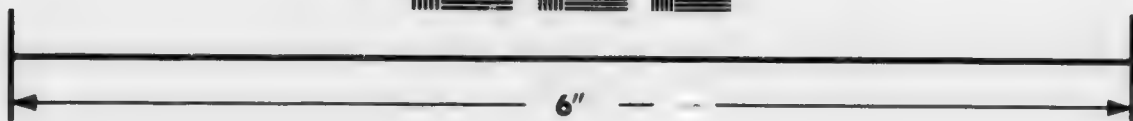
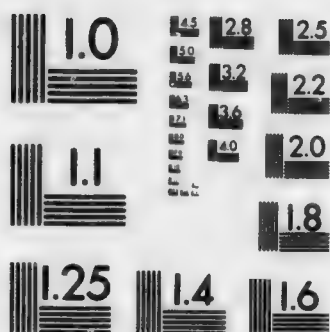


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is, a reduction of 8 times \$10, or \$80, which is the percentage; \$800 is the base, and 10 expresses the rate. Now when the percentage, \$80, is subtracted from the base, \$800, the difference \$720 is the net price.

The rate per cent. being so much per hundred, is, for the purpose of operations in percentage, conveniently expressed decimally in hundredths, that is, by two decimal figures. Thus, 5 per cent. = .05 that is, $\frac{5}{100}$; 12 per cent. = .12; $2\frac{1}{2}$ per cent. = .02 $\frac{1}{2}$ or .025. These decimal expressions, however, are really the rates per unit equal to the corresponding rates per hundred.

When the rate is an aliquot part of 100, it is often more convenient to use the common fraction expressing that part,

The student should thoroughly master the following:

100% = the whole of anything, therefore,

50 per cent.	= .50	= $\frac{1}{2}$.	20 per cent.	= .20	= $\frac{1}{5}$.
25 "	= .25	= $\frac{1}{4}$.	10 "	= .10	= $\frac{1}{10}$.
12 $\frac{1}{2}$ "	= .12 $\frac{1}{2}$	= $\frac{1}{8}$.	5 "	= .05	= $\frac{1}{20}$.
6 $\frac{1}{2}$ "	= .06 $\frac{1}{2}$	= $\frac{1}{16}$.	2 $\frac{1}{2}$ "	= .02 $\frac{1}{2}$	= $\frac{1}{40}$.
33 $\frac{1}{3}$ "	= .33 $\frac{1}{3}$	= $\frac{1}{3}$.	1 $\frac{1}{4}$ "	= .01 $\frac{1}{4}$	= $\frac{1}{80}$.
16 $\frac{2}{3}$ "	= .16 $\frac{2}{3}$	= $\frac{1}{6}$.	2 "	= .02	= $\frac{1}{50}$.
8 $\frac{1}{3}$ "	= .08 $\frac{1}{3}$	= $\frac{1}{12}$.	4 "	= .04	= $\frac{1}{25}$.
1 "	= .01	= $\frac{1}{100}$.			
$\frac{1}{2}$ per cent., that is, $\frac{1}{2}$ of 1 per cent.	= .005	= $\frac{1}{200}$.			
$\frac{1}{4}$ "	"	$\frac{1}{4}$ of 1 "	= .0025	= $\frac{1}{400}$.	
$\frac{3}{4}$ "	"	$\frac{3}{4}$ of 1 "	= .0075	= $\frac{3}{400}$.	
$\frac{1}{8}$ "	"	$\frac{1}{8}$ of 1 "	= .00125	= $\frac{1}{800}$.	
$\frac{3}{8}$ "	"	$\frac{3}{8}$ of 1 "	= .00375	= $\frac{3}{800}$.	
$\frac{5}{8}$ "	"	$\frac{5}{8}$ of 1 "	= .00625	= $\frac{5}{800}$ = $\frac{1}{160}$.	
$\frac{7}{8}$ "	"	$\frac{7}{8}$ of 1 "	= .00875	= $\frac{7}{800}$.	
$\frac{1}{10}$ "	"	$\frac{1}{10}$ of 1 "	= .000625	= $\frac{1}{1600}$.	
$\frac{3}{10}$ "	"	$\frac{3}{10}$ of 1 "	= .0003125	= $\frac{3}{3200}$.	
$\frac{1}{5}$ "	"	$\frac{1}{5}$ of 1 "	= .002	= $\frac{1}{500}$.	
$\frac{2}{5}$ "	"	$\frac{2}{5}$ of 1 "	= .004	= $\frac{1}{250}$.	
$\frac{3}{5}$ "	"	$\frac{3}{5}$ of 1 "	= .006	= $\frac{3}{500}$.	
$\frac{4}{5}$ "	"	$\frac{4}{5}$ of 1 "	= .008	= $\frac{4}{500}$.	
$\frac{1}{100}$ "	"	$\frac{1}{100}$ of 1 "	= .003	= $\frac{3}{1000}$.	
$\frac{7}{100}$ "	"	$\frac{7}{100}$ of 1 "	= .007	= $\frac{7}{1000}$.	
$\frac{1}{100}$ "	"	$\frac{1}{100}$ of 1 "	= .001	= $\frac{1}{1000}$.	

Taking example I above, we have the following formulæ:

$$\begin{array}{l} \text{Base.} \quad \text{Rate.} \\ 500 \times .08 = 40 \text{ percentage; therefore,} \\ \text{Percentage.} \quad \text{Base.} \\ 40 \div 500 = .08 \text{ rate, and} \\ \text{Percentage.} \quad \text{Rate.} \\ 40 \div .08 = 500 \text{ base.} \end{array}$$

From which we have the following:

I.—Given the Base and Rate to find the percentage.

RULE.—Multiply the base by the rate expressed decimally; the product will be the percentage.

II.—Given the Base and Percentage to find the rate.

RULE.—Divide the percentage by the base; the quotient will be the rate expressed decimally.

III.—Given the Percentage and Rate to find the Base.

RULE.—Divide the percentage by the rate expressed decimally; the quotient will be the base.

EXERCISES.

Find the percentage on:

- | | | | |
|--------------|--------------------|--------------|---------------------|
| 1. 630 | @ 6 per cent. | 9. \$8000 | @ 19 per cent. |
| 2. 540 | " 7 " | 10. \$789 | " 37 " |
| 3. 1825 | " $2\frac{1}{2}$ " | 11. 765 | " 44 " |
| 4. 2648 | " 12 " | 12. 4800 | " 65 " |
| 5. \$428.20 | " 8 " | 13. \$1300 | " $62\frac{1}{2}$ " |
| 6. \$1724.50 | " $7\frac{1}{2}$ " | 14. \$2500 | " $17\frac{1}{4}$ " |
| 7. \$1728 | " $\frac{1}{2}$ " | 15. \$176.40 | " $9\frac{1}{4}$ " |
| 8. \$975 | " $1\frac{1}{2}$ " | 16. 877.5 | " 90 " |

Find the base when the percentage is:

- | | |
|-----------------------------|--|
| 17. \$37.50 and the rate 6. | 21. \$23.75 and the rate $9\frac{1}{2}$. |
| 18. \$39.45 " " 5. | 22. \$57.03 " " $7\frac{1}{2}$. |
| 19. \$6.50 " " 2. | 23. \$62.69 $\frac{1}{4}$ " " $6\frac{1}{2}$. |
| 20. 45 cents " " 3. | 24. 147.693 " " 46. |

25.	12.125	and the rate	12½.	31.	13½	and the rate	3.
26.	297.081	"	" 18.	32.	68 cents	"	" ½.
27.	688.856	"	" 28.	33.	\$152.19	"	" 23½.
28.	\$4.35	"	" 25.	34.	8.4	"	" 16.
29.	\$86.34½	"	" 18½.	35.	\$10.80	"	" 16.
30.	\$2.25	"	" ½.	36.	216	"	" 3.

Find the rate when base is :

37.	\$560	and the percentage	\$33.60.
38.	\$4.60	"	\$826.
39.	\$2460	"	\$246.
40.	\$1568	"	\$172.48.
41.	20000	"	3000.
42.	1800	"	27.
43.	1728	"	43.2.
44.	4600	"	3220.
45.	25000	"	1875.
46.	32	"	24.
47.	\$1275	"	\$63.75.
48.	600 bush.	"	3 bush.
49.	1800	"	459 "
50.	\$720	"	\$1.80.
51.	\$125.50	"	\$753.
52.	\$120.80	"	\$75½.

53. A merchant bought goods costing \$580, and sold them at a profit of 35%. What was his gain?

54. A commission merchant sold goods for another to the amount of \$625.40, and charged 5½% for his trouble. How much did he earn?

55. An auctioneer who charged 1½% for selling goods for another earned in one day \$19.50. What did his sales amount to?

56. If the interest of \$750 for 1 year is \$33.75, what rate per cent. is the money earning?

57. A man bought a horse for \$125, and by selling him gained \$26.50. What rate per cent. of profit did he make?

58. The regular price of a musical instrument was \$520, but the vendor sold it for \$442. What rate of discount did he allow?

$$\begin{array}{r} 250 \\ 125 \\ \hline 375 \\ 109.3750 \end{array}$$

$$\begin{array}{r} 312.50 \\ 109.3750 \\ \hline 203.1250 \end{array}$$

$$\begin{array}{r} 203.1250 \\ 109.3750 \\ \hline 103.7500 \end{array}$$

PERCENTAGE.

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59. The retail price of a book was \$2.50 per copy. What would the discount to a wholesale buyer amount to on 125 copies at 35%.

60. What rate per cent. of profit would the buyer, as in the last question, make by selling the book at the retail price?

As already explained, the amount is the base plus the percentage, and the net is the base minus the percentage.

Taking 1 as the base, the *amount* is $1 +$ the rate expressed decimally. Thus, @ 7% the amount of 1 is 1.07, and @ $\frac{1}{2}\%$ the amount of 1 is 1.005, &c.

Also the *net* of 1 is $1 -$ the rate expressed decimally. Thus, @ 7% the net of 1 $- .07 = .93$, and at $\frac{1}{2}\%$ the net of 1 is $1 - .005 = .995$.

Taking 800 as base, and 5% as rate, we have the following formulæ:

800, base $\times 1.05$, amt. of 1 = 840, amount; therefore,
 840, amt. $\div 1.05$, amt. of 1 = 800, base, and
 840, amt. $\div$ 800, base = 1.05 amt. of 1, from which subtract
 1, and the remainder, .05, is the rate expressed decimally. Also,
 800, base $\times .95$, net of 1 = 760 net; therefore,
 760, net $\div .95$, net of 1 = 800 base, and
 760, net $\div$ 800, base = .95 net of 1, which subtracted from
 1 = .05, the rate expressed decimally.

Hence the following:

I.—Given the Base and Rate to find the Amount.

RULE.—Multiply the base by the amount of 1; the product will be the amount required.

II.—Given the Amount and Rate to find the Base.

RULE.—Divide the given amount by the amount of 1; the quotient will be the base.

III.—Given the Amount and Base to find the Rate.

RULE.—Divide the given amount by the base; the quotient will be the amount of 1, from which subtract 1, and the remainder will be the rate expressed decimally.

Also, I.—Given the Base and Rate to find the Net.

RULE.—Multiply the given base by the net of 1; the product will be the net required.

II.—Given the Net and Rate to find the Base.

RULE.—Divide the given net by the net of 1; the quotient will be the base required.

III.—Given the Net and Base to find the Rate.

RULE.—Divide the given net by the base; the quotient will be the net of 1. Subtract this net of 1 from 1, and the remainder will be the rate expressed decimally.

EXERCISES.

Find the amount of:

- | | |
|------------------------------|---|
| 61. \$725 @ 7 per cent. | 66. 540 @ $1\frac{1}{4}$ per cent. |
| 62. \$457 " 6 " | 67. 36 " 28 " |
| 63. \$824 " $5\frac{1}{2}$ " | 68. 420 " 52 " |
| 64. \$1283.50 " 8 " | 69. 240 " $\frac{3}{4}$ " |
| 65. 246 " $3\frac{1}{2}$ " | 70. \$4.44 $\frac{1}{4}$ " $9\frac{1}{2}$ " |

Find the bases which produce the following amounts at the rates given:

- | | |
|--|---|
| 71. \$775.75 @ 7 per cent. | 76. \$1256.25 @ $\frac{1}{2}$ per cent. |
| 72. 872 " 9 | 77. \$842.10 " $\frac{1}{4}$ " |
| 73. 26.37 $\frac{1}{2}$ " $5\frac{1}{2}$ | 78. \$84.97 $\frac{1}{4}$ " $\frac{3}{4}$ " |
| 74. 546.75 " $1\frac{1}{4}$ | 79. 2100 " $16\frac{3}{4}$ " |
| 75. 810 " 35 | 80. \$4.85 $\frac{1}{4}$ " 9 " |

Find the rates with the following bases and amounts:

- | | |
|---------------------------|---|
| 81. Base 80, Amount 96. | 87. Base \$280, Amount \$282.24. |
| 82. " 360 " 378. | 88. \$555.60 " \$1000.08. |
| 83. " 590 " 649. | 89. \$432.50 " \$467.10. |
| 84. " \$428 " \$464.38. | 90. \$2472 " \$2475.09. |
| 85. " \$750 " \$753.75. | 91. \$528.80 " \$594.90. |
| 86. " \$1640 " \$1648.20. | 92. \$168.20 " \$170.30 $\frac{1}{4}$. |

Find the net of:

- | | |
|----------------------------|----------------------------------|
| 93. 450 @ 6 per cent. | 97. 480 @ 12 per cent. |
| 94. 720 " 5 " | 98. \$365.50 " 10 " |
| 95. 56 " 25 " | 99. \$584.30 " 40 " |
| 96. 1200 " $\frac{1}{4}$ " | 100. \$187.50 " $5\frac{1}{2}$ " |

Find the bases which produce the following nets at the rates given:

- | | |
|--------------------------------|--|
| 101. 228 @ 5 per cent. | 106. \$1094.50 @ $79\frac{1}{2}$ per cent. |
| 102. 312 " 4 " | 107. \$79 " $1\frac{1}{2}$ " |
| 103. 549 " $8\frac{1}{2}$ " | 108. \$8.75 " $12\frac{1}{2}$ " |
| 104. \$248.43 " 35 " | 109. \$140.86 $\frac{1}{2}$ " 45 " |
| 105. \$1885 " $5\frac{1}{2}$ " | 110. \$925.20 " $3\frac{1}{2}$ " |

Find the rates with the following bases and nets:

- | | |
|---------------------------|---|
| 111. Base 240, Net 228. | 116. Base \$.75, Net \$.50. |
| 112. " 850, " 799. | 117. " \$1.25, " \$.87 $\frac{1}{2}$. |
| 113. " 156, " 117. | 118. " \$468.80, " \$457.08. |
| 114. " \$12.60, " \$7.56. | 119. " \$36.50, " \$31.02 $\frac{1}{2}$. |
| 115. " \$756, " \$661.50. | 120. " \$4.20, " \$3.50. |

121. A note for \$375 amounted at the end of one year to \$391.87 $\frac{1}{2}$; at what rate was the interest?

122. A draft on New York was bought for \$633.60 @ 12% discount; what was the face of it?

123. The amount of a note @ 7% for one year was \$179.50; what was the face of it?

124. Bank Stock, the par value of which was \$1200, was sold @ 35% premium; what did it realize?

125. A man sold a horse for \$93.50, losing 15%; what did the horse cost him?

126. A merchant found that his profit on an investment was \$1365, and that it was 21%; how much was his investment?

127. The capital of a bank was \$800,000, and its profits in one year amounted to \$108,000; what was the rate per cent. of profit.

128. The wholesale price of cloth was \$2.45 per yard, which was 30% from the retail price; what was the retail price?

129. A stationer sells pens which cost him 50 cents per gross, at 75 cents per gross; what is his rate per cent. of profit?

130. The invoice price of goods imported was \$140, and the cost of importation was $22\frac{1}{2}\%$; what was the full cost?

131. A manufacturing company imported a steam engine and boiler, the maker's price of which was \$7600, and the full cost to the importer \$10222; what rate per cent. did it cost to import?

132. Purchased a draft for \$1628 on Montreal for \$1632.07; at what rate was it purchased?

133. I have \$641.70 to invest in a draft which I can buy @ $\frac{1}{4}\%$ premium; what will be the face of the draft?

134. The population of a city increased from 25000 to 27750; what was the rate per cent. of increase?

135. A merchant's capital at the beginning of a year was \$13500, and at the end of the same year it was \$15750; what rate per cent. of profit did he make during the year?

136. A lawyer collected \$2785 for a client, and paid over \$2545.75, retaining the balance as commission; what rate per cent. was his commission?

137. A gentleman invested 42% of his capital in real estate, and had \$48024 left; what was his capital?

138. A citizen neglected to pay his taxes until $2\frac{1}{2}\%$ was added on account of delay, he then had to pay \$48.79; what was his original tax bill?

139. The assets of a bankrupt are \$14268, and his liabilities \$34800; what per cent. can the estate pay?

140. A merchant paid for goods \$438, and sold them for \$350.40; what per cent. of the cost did he lose?

141. A commission merchant sold for a miller 450 barrels flour @ \$5.75 per barrel, and remitted the net proceeds by a draft; what was the face of the draft if the merchant's commission and charges were equal to 4%, and the draft was purchased at $\frac{3}{4}\%$ discount.

SPECIAL METHODS AND EXERCISES.

Since 1% is $\frac{1}{100}$, and since to find $\frac{1}{100}$ of any number is to divide by 100, and since to divide by 100 is to move the decimal

point, expressed or understood, *two* places to the *left*, or the figures *two* places to the *right*, therefore,

To find 1% of any number.

Move the decimal point TWO places to the LEFT; or, leaving the decimal point in the same place or column, move the figures TWO places to the RIGHT.

EXEROISES.

Read 1% of each of the following quantities: \$140; \$750; \$17.50; \$2384.50; \$1625.25; \$986.75; \$1.90; \$16; \$10; \$12.50; \$.90; \$.75; 180; 5300; 10000; 1346; 1563720.

Write under each of the following numbers, to add or subtract as required, 1% of the same:

\$630; \$955; \$1865; \$180.50; \$16.20; \$584.50; \$4.44; \$4.86; \$486.66; \$484.44; \$480; \$4.87; \$5; \$10; \$500; \$4.83; \$4.81; 980; 71.6; 1750; 8.43; 4883; 20000; 416; 3.1416; \$4.82; 745 tons.

Since 100% of anything is the whole of it, 10% is $\frac{1}{10}$; and since $\frac{1}{10}$ of a number is found by dividing it by 10, and to divide by 10 is to move the decimal point *one* place to the *left*, or the figures *one* place to the *right*, therefore,

To find 10% of any number.

Move the decimal point ONE place to the LEFT; or, leaving the decimal point in the same place or column, move the figures ONE place to the RIGHT.

EXEROISES.

Read 10% of each of the following quantities:

\$648; \$246; \$366; \$240; \$360; \$750; \$350; \$29.40; \$976.80; \$453.25; \$15.68; \$35.28; \$3504.90; \$4.50; \$4500; 186; 940.5; 725.8.

Write under each of the following numbers, to add or subtract as required, 10% of the same:

\$1023; \$1812; \$303.90; \$151.50; \$166.40; \$315.70; \$331.40;

PERCENTAGE.

\$419.80; \$1504.50; \$305.55; \$898.29; \$261.44; \$72.90; 1020;
4.86 $\frac{1}{2}$; 44.4; \$4.44 $\frac{1}{2}$; \$4.88 $\frac{1}{2}$; \$4.83.

Of course 2% is twice 1%, and 3% is 3 times 1%, and so on. Now as 1% of any number is simply the figures of that number shifted two places to the right, 2% is twice those figures shifted two places to the right, and 3% is 3 times, &c., and so on to 9%. Therefore,

If it be required to add to, or subtract from, any base any percentage at any integral rate from 2 to 9 inclusive,

Write the product of the base by the rate under the base, but two places to the right; then perform the addition or subtraction.

EXAMPLE.—1. To \$538 add 6%.

OPERATION.

\$538	base.
32.28	6% add.
\$570.28	amount.

EXAMPLE.—2. From \$428.50 take 8%.

OPERATION.

\$428.50	base.
34.28	8% subtract.
\$394.22	net.

N. B.—The multiplication is to be performed without writing the multiplier.

EXERCISES.

- | | | | |
|----------------|-----------------|----------------|------------------|
| 1. To 24 | add 5 per cent. | 10. From 550 | take 4 per cent. |
| 2. " 460 | " 5 " | 11. " 1240 | " 5 " |
| 3. " 325 | " 6 " | 12. " \$3 | " 2 " |
| 4. " \$145 | " 4 " | 13. " \$43.50 | " 6 " |
| 5. " \$630 | " 8 " | 14. " \$1.50 | " 8 " |
| 6. " \$12365 | " 2 " | 15. " \$1700 | " 9 " |
| 7. " \$4667.20 | " 3 " | 16. " \$910 | " 3 " |
| 8. " \$528.50 | " 7 " | 17. " \$625 | " 7 " |
| 9. " \$1500 | " 9 " | 18. " \$485.50 | " 6 " |

Since 10% of any number is simply the figures of that number shifted *one* place to the right, twice those figures shifted one place to the right give 20% and 3 times, 30%, and so on. Therefore,

If it be required to add to, or subtract from, any base a percentage at any rate which is a multiple of 10, from 20 to 90 inclusive,

Write the product of the base by the tens figure of the rate under the base, but one place to the right, then add or subtract as required.

EXAMPLE.—1. To \$725.25 add 40%.

OPERATION.

\$725.25	base,
290.100	40% add.
\$1015.35	amount.

EXAMPLE.—2. From 1420 take 70%.

OPERATION.

1420	base,
994.0	70% subtract.
426	net.

EXERCISES

- | | | | |
|----------------|------------------|---------------|-------------------|
| 19. To 400 | add 20 per cent. | 27. From 1700 | take 90 per cent. |
| 20. " 1850 | " 40 " | 28. " 700 | " 80 " |
| 21. " 720 | " 50 " | 29. " 650 | " 70 " |
| 22. " \$1625 | " 60 " | 30. " 270 | " 60 " |
| 23. " \$564.20 | " 70 " | 31. " 385 | " 50 " |
| 24. " \$392.25 | " 80 " | 32. " \$574 | " 40 " |
| 25. " \$63.75 | " 90 " | 33. " \$87.50 | " 30 " |
| 26. " 600 | " 30 " | 34. " \$12.25 | " 20 " |

The percentage at any other rate not containing a fraction may be readily written below a given base, convenient to add or subtract, by combining the last two cases.

PERCENTAGE.

EXAMPLE.—1. To \$825 add 27%.

OPERATION.

\$825	base.
165.0	20%
57.75	7%

\$1047.75 amount at 27%.

EXAMPLE.—2. From \$458.60 take 36%.

OPERATION.

\$458.60	base.
137.580	30%
27.5160	6%

\$165.10 sum 36% subtract from the base.
\$293.50 net to the nearest cent @ 36%.

EXERCISES.

- | | |
|------------------------------|-------------------------------|
| 35. To 480 add 35 per cent. | 40. To \$.56 add 37 per cent. |
| 36. " 368 " 67 " | 41. " \$12.40 " 29 " |
| 37. " 725 " 42 " | 42. " \$1900 " 64 " |
| 38. " \$1260 " 71 " | 43. " \$824.50 " 58 " |
| 39. " \$1.85 " 18 " | 44. " \$1272 " 75 " |
| 45. From 590 take 85 per ct. | 50. From \$60 take 31 per ct. |
| 46. " 14000 " 79 " | 51. " \$846.25 " 28 " |
| 47. " 4210 " 14 " | 52. " \$1612.80 " 65 " |
| 48. " \$19.20 " 45 " | 53. " \$525 " 19 " |
| 49. " \$625 " 55 " | 54. " \$16.40 " 72 " |

Fractional rates are similar fractional parts of 1%. Thus, $\frac{1}{2}\%$ is $\frac{1}{2}$ of 1%, and $\frac{1}{4}\%$ is $\frac{1}{4}$ of 1%, and so on.

When a percentage at a fractional rate is to be added to, or subtracted from, a given base, it may be readily written below the base, convenient for that purpose, by taking such part or parts of the base as are expressed by the rate, and setting them under the base, two places to the right. Thus,

EXAMPLE.—1. To \$240 add $\frac{1}{4}\%$.

OPERATION.

\$240.00 base.
 $\frac{1}{4} = .30 = \frac{1}{4}$ of \$240 set two places to the right.
\$240.30 amount @ $\frac{1}{4}\%$.

EXAMPLE—2. From \$1264 take $\frac{1}{4}\%$.

OPERATION.

\$1264.00 base.

$\frac{1}{4}\% = 6.32 = \frac{1}{4}$ of 1264 set two places to the right.

$\frac{1}{4}\% = \frac{1}{4}$ of $\frac{1}{4}\% = 3.16$

9.48 = $\frac{1}{4}\%$ subtract from the base.

\$1254.52 net @ $\frac{1}{4}\%$.

EXERCISES.

Give the answers to the nearest cent.

- | | |
|---|--|
| 55. To 2000 add $\frac{1}{4}$ per cent. | 66. To \$5 add $7\frac{1}{2}$ per cent. |
| 56. " 1200 " $\frac{1}{4}$ " | 67. " \$4.20 " $16\frac{1}{2}$ " |
| 57. " \$1680 " $\frac{1}{4}$ " | 68. " \$4220 " $24\frac{1}{2}$ " |
| 58. " \$480 " $\frac{1}{4}$ " | 69. " \$4.44 $\frac{1}{2}$ " $9\frac{1}{2}$ " |
| 59. " \$1900 " $\frac{1}{4}$ " | 70. " \$4.44 $\frac{1}{2}$ " $8\frac{1}{2}$ " |
| 60. " \$225 " $\frac{1}{4}$ " | 71. " \$4.44 $\frac{1}{2}$ " $10\frac{1}{2}$ " |
| 61. " \$1080 " $\frac{1}{4}$ " | 72. " \$4.44 $\frac{1}{2}$ " $9\frac{1}{2}$ " |
| 62. " \$462.50 " $\frac{1}{4}$ " | 73. " \$4.44 $\frac{1}{2}$ " $8\frac{1}{2}$ " |
| 63. " \$875 " $\frac{1}{4}$ " | 74. " \$4.44 $\frac{1}{2}$ " $9\frac{1}{2}$ " |
| 64. " \$770 " $\frac{1}{4}$ " | 75. " \$1400 " $43\frac{1}{2}$ " |
| 65. " \$478.20 " $3\frac{1}{2}$ " | 76. " \$2160 " $56\frac{1}{2}$ " |
| 77. From \$125 take $\frac{1}{4}$ per cent. | 81. From \$680 take $\frac{1}{4}$ per cent. |
| 78. " \$960 " $\frac{1}{4}$ " | 82. " \$1760 " $\frac{1}{4}$ " |
| 79. " \$75 " $\frac{1}{4}$ " | 83. " \$2500 " $7\frac{1}{2}$ " |
| 80. " \$84 " $\frac{1}{4}$ " | 84. " \$12500 " $35\frac{1}{2}$ " |

The following exercises are to be done by taking aliquot parts of 100%.

- | | |
|--------------------------------|--|
| 85. Find 25 p. c. of 1880. | 89. Find $37\frac{1}{2}$ p. c. of \$240. |
| 86. " 50 " 2400. | 90. " $62\frac{1}{2}$ " \$1760.80. |
| 87. " $12\frac{1}{2}$ " 36000. | 91. " 75 " \$19.20. |
| 88. " 20 " \$1240.50. | 92. " $87\frac{1}{2}$ " \$125. |

INTEREST.

Interest is payment made, or compensation allowed for the use of money.

Interest is paid on money borrowed, on obligations assumed, and on money retained after it has become due.

Interest is not recoverable on credit accounts even after the usual term of credit has expired, unless there is an agreement on the part of the debtor to pay interest.

The usage of trade, however, modifies this law in the case of wholesale dealers, and where such is the usage, interest can be recovered without an express agreement to pay interest, and without notice on the part of the creditor, that interest will be claimed.

Four elements enter into calculations of interest, viz: **Principal, rate, time and interest**—any three of which being given, the fourth can be found.

The **Principal** is the sum for the use of which interest is paid.

The **Rate** is so much per cent. of the principal for 1 year.

The **Time** is the period, expressed in years, months or days during which the interest accrues.

The **Interest** for 1 year is the percentage of the principal at the rate given; and for any other period is such a multiple or part of that percentage as the given time is of 1 year.

The **Amount** is the sum of the principal and interest.

Legal Interest is interest at the rate fixed by law.

Usury is interest at a higher rate than that allowed by law, and such excessive interest is said to be usurious.

Formerly stringent laws existed in most countries fixing the rates of interest, and heavy penalties were exacted for violation of them; and, though such laws are still in force in many places, the tendency of late years has been towards freedom in this, as in other matters of trade. In this country the laws limit in some degree the rates of interest.

When no rate is agreed upon in writing the legal rate is 6 per cent. On mortgages of real estate or chattels real the interest in Nova Scotia must not be at a higher rate than 7 per cent. In the absence of real estate security as high as 10 per cent. may be charged by agreement in writing. There is no penalty for exceeding these rates except that the courts will deduct the excess from claims where higher rates have been charged.

In New Brunswick and Prince Edward Island any rate may be charged by agreement in writing, except by banks and incorporated companies, governed by special acts.

Banks generally are limited to 7 per cent., and no higher rate is recoverable by them; but there is no penalty for taking a higher rate so that practically they are unrestricted.

The above restrictions do not apply to rates charged for money loaned on bottomry, upon which any rate stipulated for under the general laws of bottomry is recoverable.

Generally interest is chargeable for any length of time only on the principal sum loaned, or debt due and forborne, which is not to be increased for the purpose of reckoning interest by the addition of interest overdue, and such interest is known as **Simple Interest**.

When the interest due at the end of a stated period, as 1 year, is added to the principal, and interest reckoned for the next succeeding period on the amount, and so on from period to period, such interest is called **Compound Interest**, which will be treated under a separate head.

I.—To find the interest on any principal for 1 year at any rate per cent.

RULE.—*Find the percentage on the principal at the given rate; such percentage will be the interest required. Or,*

Multiply the principal by the rate per cent. and divide the product by 100.

EXERCISES.

Find the interests of the following sums for 1 year, at the rates given :

INTEREST.

1. \$15	@ 3 per cent.	6. \$6.40	@ $8\frac{1}{2}$ per cent.
2. \$35	" 5 "	7. \$250	" $9\frac{1}{2}$ "
3. \$120	" 7 "	8. \$760.40	" $7\frac{1}{2}$ "
4. \$2.25	" 8 "	9. \$964.50	" $6\frac{1}{2}$ "
5. \$175.50	" 6 "	10. \$568.75	" $7\frac{1}{2}$ "

II.—To find the interest of any principal for any number of years.

RULE.—Find the interest for 1 year, and multiply it by the number of years.

EXERCISES.

What are the interests of the following sums for the periods, and at the rates given :

1. \$4.60	for 3 y. @ 6 per ct.	7. \$1650.45	for 2 y. at 9 per ct.
2. \$570	" 5 y. " 7 "	8. \$964.75	" 4 y. " 10 "
3. \$680	" 4 y. " $7\frac{1}{2}$ "	9. \$1674.50	" 3 y. " $10\frac{1}{2}$ "
4. \$460.50	" 3 y. " $6\frac{1}{2}$ "	10. \$640.80	" 5 y. " $4\frac{1}{2}$ "
5. \$17.40	" 3 y. " $8\frac{1}{2}$ "	11. 965.50	" 7 y. " $5\frac{1}{2}$ "
6. \$321.05	" 8 y. " $5\frac{1}{2}$ "	12. 2460.20	" 4 y. " 7 "

III.—To find the interest of any sum of money for any number of months.

RULE.—Find the interest for one year, and take aliquot parts for the months ; or,

Find the interest for one year, divide by 12, and multiply the quotient by the number of months.

EXERCISES.

What are the interests of the following sums for the periods, and at the rates given :

1. \$740	for 6 months @ 7 per cent.
2. \$684.20	" 4 " " 6 "
3. \$529.30	" 3 " " 7 "
4. \$760.50	" 2 " " 7 "

5.	\$1728.28	for	9 months	@	$8\frac{1}{2}$	per cent.
6.	\$1575.54	"	8 "	"	$6\frac{1}{2}$	"
7.	\$1500	"	7 "	"	10	"
8.	\$899.99	"	5 "	"	7	"
9.	\$964.50	"	10 "	"	9	"
10.	\$1560	"	11 "	"	$7\frac{1}{2}$	"
11.	\$268.25	"	13 "	"	7	"
12.	\$1569.45	"	1 y. 3 m.	"	8	"
13.	\$643	"	1 y. 5 m.	"	10	"
14.	\$560.45	"	1 y. 6 m.	"	$9\frac{1}{2}$	"
15.	\$48.50	"	3 y. 9 m.	"	$10\frac{1}{2}$	"
16.	\$560.80	"	2 y. 8 m.	"	$11\frac{1}{2}$	"
17.	\$2360.40	"	19 m.	"	12	"
18.	\$2500	"	7 m.	"	$5\frac{1}{2}$	"

When the time is expressed in months and days, find the interest for the months as above, and take aliquot parts for the days. For this purpose a month is reckoned as 30 days.

Find the interests of the following sums :

19.	\$468.75	for	1 m. 15 d.	@	7	per cent.
20.	\$1654.40	"	7 m. 18 d.	"	5	"
21.	\$345.65	"	8 m. 20 d.	"	6	"
22.	\$74.85	"	2 m. 22 d.	"	9	"
23.	\$673.75	"	8 m. 25 d.	"	$7\frac{1}{2}$	"
24.	\$57.45	"	1 y. 2 m. 12 d.	"	6	"
25.	\$1763.25	"	3 m. 18 d.	"	$5\frac{1}{2}$	"
26.	\$485.15	"	11 m. 25 d.	"	$6\frac{1}{2}$	"
27.	\$48.90	"	5 m. 27 d.	"	6	"
28.	\$193.70	"	10 m. 19 d.	"	7	"
29.	\$2647	"	1 y. 5 m. 18 d.	"	$6\frac{1}{2}$	"
30.	\$268.40	"	2 y. 1 m. 1 d.	"	8	"
31.	\$2345.50	"	3 y. 7 m. 20 d.	"	10	"
32.	\$4268.45	"	4 y. 11 m. 11 d.	"	$11\frac{1}{2}$	"
33.	\$642.20	"	2 y. 7 m. 24 d.	"	12	"
34.	\$64.50	"	2 y. 11 m. 2 d.	"	7	"
35.	\$746.25	"	1 y. 10 m. 12 d.	"	5	"
36.	\$680	"	4 y. 9 m. 29 d.	"	6	"

IV.—The practice of finding the time between two dates in

months and days and working the interest therefor is attended with some inaccuracy, since the same interest is, by such a method, allowed for one month as for another, whereas the months are of unequal lengths. In order to be accurate and uniform we must find the exact number of days and reckon them as so many 365th of a year. This is the usual method employed in banks and merchants' offices.

EXAMPLE.—What is the interest of \$528 for 65 days @ 5%?

First find the interest for 1 year, then, if the interest for 1 year be divided by 365, the quotient will be the interest for 1 day; and if the interest for 1 day be multiplied by any number the product will be the interest for as many days. Now, of course, we may, if we choose, invert the order of the last two processes without affecting the result, and it will be found the easier method to do so. That is, multiply the interest for 1 year by the number of days, and divide the product by 365. The whole operation will then stand thus:

$$\begin{array}{r}
 \$528 \text{ principal.} \\
 \quad 5 \text{ rate per cent.} \\
 \hline
 \$26.40 \text{ interest for 1 year.} \\
 \quad 65 \text{ number of days.} \\
 \hline
 13200 \\
 15840 \\
 \hline
 365 \overline{)1716.00} (4.70, \text{ that is, } \$4.70 \text{ interest for 65 days @ 5\%.} \\
 \underline{1460} \\
 2560 \\
 \underline{2555} \\
 50
 \end{array}$$

From the above we have the following:

To find the interest for any number of days.

RULE.—*First find the interest for 1 year, then multiply this interest by the number of days, and divide the product by 365.*

A method somewhat shorter than the above will be arrived at by examining the following:

The interest of \$1 @ 5 per cent. for 365 days is 5 cents,
 therefore " " " " 73 " 1 cent,
 and " " " " 1 day is $\frac{1}{73}$ of a ct.,
 and taking the example given above,

The interest of \$1 @ 5 per cent. for 65 days is $\frac{65}{73}$ of a ct.

Now since $\frac{65}{73}$ of a cent is the interest of \$1 for 65 days the interest of any number of dollars is as many times $\frac{65}{73}$ of a cent. That is, the interest of \$528 = $\frac{65}{73} \times 528 = \frac{34320}{73} = 470$ cents, which divided by 100 = \$4.70, which is the interest of \$528 for 65 days at 5%.

The work appears as follows :

$$\begin{array}{r}
 528 \\
 65 \\
 \hline
 2640 \\
 3168 \\
 73 \overline{)343.20} (4.70, \text{ that is, } \$4.70 \text{ answer.} \\
 \underline{292} \\
 512 \\
 \underline{511} \\
 10
 \end{array}$$

From the above we have the following:

To find the interest for any number of days at 5 per cent.

RULE.—Multiply the principal by the number of days,—divide the product by 100, and that quotient by 73.

EXERCISES.

Find the interests of the following sums for the given times @ 5%.

- | | |
|-----------------------|--------------------------|
| 1. \$600 for 30 days. | 7. \$17.50 for 120 days. |
| 2. \$570 " 34 " | 8. \$384.24 " 275 " |
| 3. \$185 " 46 " | 9. \$93.40 " 324 " |
| 4. \$854.60 " 57 " | 10. \$728.10 " 365 " |
| 5. \$963.85 " 65 " | 11. \$47.25 " 427 " |
| 6. \$245.75 " 80 " | 12. \$1600 " 18 " |

When the interest at 5% is found the interest at any other rate can easily be arrived at.

Suppose the rate is 6% and the interest at 5% is found to be \$4.70. Then—

	\$4.70,	interest at 5%.
	.94	Add interest at 1%, found by dividing by 5,
		or by multiplying by 2 and dividing by 10.
(Int. at 6%)	\$5.64	

Again suppose the rate to be 7%, and the interest at 5% is found to be \$12.85. Then—

	\$12.85,	interest at 5%.
	5.14	Add interest at 2%—found by multi-
		plying by 4 and dividing the product by
(Interest @ 7%)	\$17.99	10, that is, setting the figures in the
		product by 4 one place to the right.

Again suppose the rate to be $3\frac{1}{2}\%$, and the interest at 5% is found to be \$127.64. Then—

	\$127.64	interest at 5%.
	38.29	Subtract interest @ $1\frac{1}{2}\%$ found, to
		the nearest cent, by multiplying the
(Interest @ $3\frac{1}{2}\%$)	\$89.35	interest at 5% by 3 and setting the
		figures in the product one place to the
		right.

In explanation of the above, observe that the difference between 5% and any other rate is just so many 5ths, or twice as many 10ths, of 5%; so that for any other rate than 5%, twice as many 10ths of the interest at 5% as there are units in the difference between 5% and the given rate must be added, if the given rate is greater than 5, or subtracted if the given rate is less than 5. Also that any number of 10ths is found and placed in position to add or subtract by multiplying by the number of 10ths and setting the product one place to the right. From which we have the following:

To find interest at any rate per cent. for days.

RULE.—Find the interest @ 5 per cent. by the last rule; multiply that interest by twice the difference between 5 per cent. and the given rate, set the product under the interest at 5 per cent. with the figures shifted one place to the right, then add, if the rate is greater than 5, or subtract, if less.

EXERCISES.

Find the interests of the following sums for the periods and at the rates given :

13.	\$1200	for 20 days @ 6 per cent.		
14.	\$820	" 40 " 6 "		
15.	\$27.60	" 63 " 6 "		
16.	\$150.40	" 33 " 6 "		
17.	\$364	" 12 " 7 "		
18.	\$75.75	" 65 " 7 "		
19.	\$4832.50	" 95 " 7 "		
20.	\$168.94	" 84 " 7 "		
21.	\$56.82	" 14 " 8 "		
22.	\$464.45	" 80 " 8 "		
23.	\$19.35	" 125 " 8 "		
24.	\$15.84	" 120 " 9 "		
25.	\$639	" 186 " 9 "		
26.	\$258.80	" 243 " 9 "		
27.	\$2460	" 145 " 10 "		
28.	\$187.50	" 90 " 10 "		
29.	\$1568	" 170 " 11 "		
30.	\$171	" 24 " 4 "		
31.	\$112	" 118 " 4 "		
32.	\$225	" 94 " 4 "		
33.	\$92.30	" 236 " $4\frac{1}{2}$ "		
34.	\$111.50	" 54 " $5\frac{1}{2}$ "		
35.	\$212.60	" 278 " $5\frac{1}{2}$ "		
36.	\$125.75	" 167 " $6\frac{1}{2}$ "		
37.	\$84.50	" 53 " $6\frac{1}{2}$ "		
38.	\$268.40	" 70 " $7\frac{1}{2}$ "		
39.	\$642.20	" 309 " $7\frac{1}{2}$ "		
40.	\$96	" 261 " $3\frac{1}{2}$ "		
41.	\$240	" 68 " $3\frac{1}{2}$ "		
42.	\$480	" 135 " $9\frac{1}{2}$ "		
43.	\$17.28	" 348 " $8\frac{1}{2}$ "		
44.	\$130	" 46 " $8\frac{1}{2}$ "		
45.	\$1590	" 437 " 3 "		
46.	\$270	" 57 " $5\frac{3}{4}$ "		

47.	\$510.45	for 81 days @ $4\frac{1}{2}$	per cent.	
48.	\$91.80	" 132	" $5\frac{1}{2}$	"
49.	\$282.26	" 115	" $6\frac{1}{2}$	"
50.	\$471.18	" 95	" $6\frac{1}{2}$	"
51.	\$600	" 188	" $7\frac{1}{2}$	"
52.	\$204.89	" 55	" $7\frac{1}{2}$	"
53.	\$1568	" 173	" 11	"
54.	\$2100	" 73	" 8	"
55.	\$2688	" 235	" $11\frac{1}{2}$	"
56.	\$364.80	" 320	" $11\frac{1}{2}$	"
57.	\$69.20	from Sept. 20,	to Dec. 31,	@ 7 per cent.
58.	\$868.25	" Oct. 3,	" " "	" 6 "
59.	\$1900	" Aug. 28,	" " "	" 7 "
60.	\$85.50	" Feb. 17,	" June 30,	" 7 "
61.	\$192.20	" Mar. 4,	" " "	" 6 "
62.	\$13	" April 1,	" " "	" 6 "
63.	\$39.90	" Dec. 10, '81	" April 1, '82,	" 8 "
64.	\$325.71	" Nov. 30, '82	" May 19, '83,	" 7 "
65.	\$924.50	" March 1,	" Oct. 1,	" 7 "
66.	\$664.40	" July 31,	" Dec. 31,	" 7 "

V.—To find the PRINCIPAL, the interest, time and rate being given.

RULE.—Divide the given interest by the interest of \$1 for the given time, and at the given rate.

EXAMPLE 1. What principal will produce \$26.60 interest in 1 year at 7%?

OPERATION.
 $.07 \overline{) 26.60}$

\$380 Ans.

The interest of \$1 for 1 year @ 7% is 7 cents; and as every 7 cents of interest represents \$1 of principal, there will be as many dollars in the principal as the number of times that 7 cents are contained in the given interest.

EXAMPLE 2.—What principal will produce \$1.28 in 3 months @ 8%?

OPERATION.
 $.02 \overline{) 1.28}$

\$64 Ans.

The interest of \$1 for 1 year @ 8% is 8 cents, and therefore for 3 mos. is 2 cents, which is the divisor.

EXAMPLE 3.—What principal will produce \$12.70 in 89 days @ 6%?

INTEREST.

105

Interest of \$1 for 89 days @ 5% = $\frac{4}{100}$ of a cent, and at 6% is $\frac{5}{100}$ of $\frac{4}{100}$ = $\frac{20}{10000}$ of a cent = $\frac{2}{1000}$ of a cent.
Then $\$12.70 \div \frac{2}{1000} = 12.70 \times \frac{1000}{2} = 868.07$ Ans.

EXERCISES.

What principal will produce

1. \$4.50	interest in 1 y. 3 m.	@ 6 per cent.?
2. 77 cents	" 3 m. 9 d.	" 7 "
3. \$10.71	" 8 m. 12 d.	" 7 $\frac{1}{2}$ "
4. \$1235	" 1 y. 8 m. 12 d.	" 6 "
5. \$49.81	" 9 m. 24 d.	" 7 "
6. \$31.50	" 4 y.	" 3 $\frac{1}{2}$ "
7. \$79.30	" 2 y. 6 m. 15 d.	" 6 $\frac{1}{2}$ "
8. \$387.40	" 2 y. 8 m.	" 4 $\frac{1}{2}$ "
9. \$290	" 2 y. 6 m.	" 7 $\frac{1}{4}$ "
10. \$456	" 93 d.	" 6 "
11. \$72.10	" 125 d.	" 5 "
12. \$231.504	" 261 d.	" 7 "

VI.—To find the PRINCIPAL, the amount, time and rate being given.

RULE.—Divide the given amount by the amount of \$1 for the given time, and at the given rate.

EXAMPLE.—What principal will amount to \$391.25 in 8 m. 20 d. at 6%?

OPERATION.

$$\begin{array}{r} 1.04\frac{1}{3} \bigg) 391.25 \left(\$ \right. \\ 3.13 \quad \quad \quad 3 \bigg) 375 \text{ Ans.} \\ \hline 1173.75 \\ 939 \\ \hline 2347 \\ 2191 \\ \hline 1565 \\ 1565 \end{array}$$

\$1.04 $\frac{1}{3}$ is the amount of \$1 at the end of 8 m. 20 d.; that is, \$1 is principal, and \$.04 $\frac{1}{3}$ is the interest of it. Now the given amount, \$391.25, is found to be 375 times \$1.04 $\frac{1}{3}$; that is, it is 375 times \$.04 $\frac{1}{3}$ for interest and 375 times \$1 for principal. The required principal is therefore \$375.

EXERCISES.

What principal will amount to

1.	\$3186	in 3 years	@ 6 per cent. †
2.	\$168.30	" 1 y. 8 m.	" 8 "
3.	\$777.71	" 6 m. 10 d.	" 7 "
4.	\$617.11	" 8 m. 24 d.	" 5 "
5.	\$697.99	" 1 y. 5 m. 27 d.	" 7 "
6.	\$1358.40	" 2 y. 2 m. 12 d.	" 6 "
7.	\$400.18	" 9 m. 27 d.	" 4 "
8.	\$607.81	" 95 days	" 5 "
9.	\$255.84	" 186 days	" 6 "
10.	\$1188.34	" 368 days	" 7 "
11.	\$996.52	" 75 days	" 8 "
12.	\$5440	" 12 years	" 3 "

VII—To find the RATE, the principal, interest and time being given.

RULE.—Divide the given interest by the interest of the given principal for the given time @ 1 %.

EXAMPLE.—At what rate will \$150 produce \$15.75 interest in 1 y. 4 m. 24 d?

OPERATION.

$$\begin{array}{r} 2.10 \overline{) 15.75 (7\frac{1}{2}} \\ \underline{1470} \\ 105 \\ \underline{210} = \frac{1}{2} \end{array}$$

The interest of \$150 for 1 y. 4 m. 24 d. @ 1% is \$2.10, and the given interest is found to be $7\frac{1}{2}$ times \$2.10. The rate must therefore be $7\frac{1}{2}$ times 1%, that is $7\frac{1}{2}\%$.

EXERCISES

At what rate will

1.	\$60	produce \$3	interest in 1 year?
2.	\$40	" \$13.36	" 2 y. 9 m. 12 d?
3.	\$75	" \$1	" 2 months?
4.	\$30	" \$2.25	" 9 months?
5.	\$425	" \$11.73	" 3 m. 18 d?
6.	\$125	" \$14	" 1 y. 7 m. 6 d.?
7.	\$292	" \$3.92	" 140 days?
8.	\$373.70	" \$14.83	" 207 days?
9.	\$365	" \$13.92	" 174 days?

10. At what rate must any sum of money be on interest to double itself in 12 years?
11. At what rate must any sum be on interest to amount to three times itself in 25 years?
12. At what rate will any sum double itself in 16 y. 8 m.?

VIII.—To find the TIME, the principal, interest and rate being given

RULE.—Divide the given interest by the interest of the given principal for 1 year at the given rate.

EXAMPLE.—In what time will \$125 produce \$13.75 @ 8%?

OPERATION.

125	principal.	
8	rate.	
Int. for 1 year	$\frac{\$10.00}{\$13.75}$	given interest.
	1.375,	years—quotient by 10.
	12	
	4.500	months.
	30	
	15.000	days.

Ans. 1 y. 4 m. 15 d.

EXERCISES.

In what time will

1. \$12 @ 8 per cent. produce \$2.88 interest?
2. \$1800 " 7 " " \$315 "
3. \$1200 " 6 " " \$338 "
4. \$3825 " $5\frac{1}{2}$ " " \$151.93 $\frac{1}{2}$ "
5. \$40 " $6\frac{1}{4}$ " " 75 cts. "
6. 148.20 " 6 " amount to \$167.32?

In how many days will

7. \$672.50 @ 7 per cent. amount to \$683.33?
8. \$856.88 " 5 " produce \$7.63 interest?
9. \$2000 " $7\frac{1}{2}$ " " \$76.85 "
10. In what time will any sum double itself at 6%?

11. In what time will any sum quadruple itself @ 9 %?
12. Borrowed a sum of money on June 3, 1868 @ 7% agreeing to settle the account when the interest should be equal to the principal. When was it due?

ACCOUNTS CURRENT WITH INTEREST.

It is customary for wholesale merchants in rendering their regular half-yearly accounts to their customers, to charge interest up to the time of rendering the account on such items of the Dr. side as fall due prior to that date, and also on such items of the Cr. side as fall due after said date, from the time of rendering the account to the dates on which they severally fall due; and allow interest in like manner on such items of the Cr. side as fall due before the said date, and also on such items of the Dr. side as fall due after said date. Such an account with the interest reckoned in it is called an **Account Current with Interest**.

As an illustration let us suppose the following account to be rendered on June 30th, and the mdse. items to be on 3 months' credit:

Dr.		JOHN SMITH.				Cr.			
Jan.	18	To Mdse.	321	80	Mar.	27	By Cash	200	00
Feb.	6	" "	145	00	May	17	" "	450	00
Mar.	10	" "	264	20	June	16	" Mdse.	242	75
Apl.	25	" "	168	12		21	" Cash	150	00
May	17	" "	563	35					
June	4	" "	440	00					

The mdse. items being on 3 months' credit, all the items on the Dr. side, and the third item on the Cr. side fall due 3 months after their several dates, that is, the first item, on April 18, the second, on May 6, &c.

On the first item interest is reckoned from April 18 to June 30—73 days; on the second item, from May 6 to June 30—55 days; on the third item, from June 10 to June 30—20 days; and these items of interest go to increase the Dr. side of the account. The last three items on the Dr. side do not fall due until after June 30. That of April 25 falls due on July 25, and on this interest is reckoned from June 30 to July 25—25 days; on the next from June 30 to Aug. 17—48 days, and on the last from June 30 to Sep. 4—66 days, and these items of interest go to diminish the Dr. side, or, which amounts to the same thing, to increase the Cr. side of the account. They are written in red ink on the Dr.

side, and their sum is transferred to the interest column on the Cr. side in black with the explanation "Interest in red," and there added with the interest on that side.

The first item on the Cr. side is Cash, and interest is reckoned on this from March 27 to June 30—95 days; on the second item interest is reckoned from May 17 to June 30—44 days, and on the fourth item from June 21 to June 30—9 days; and these items of interest go to increase the Cr. side of the account. The third item, being mdae., does not fall due till Sep. 16, and on this interest is reckoned from June 30 to Sep. 16—78 days, and this interest goes to diminish the Cr. side, or, which amounts to the same thing, to increase the Dr. side of the account. It is written in red ink on the Cr. side and transferred to the interest column on the Dr. side in black with the explanation "Interest in red," and there added with the interest on that side.

It is usual, instead of adding the interest to the principal on each side of the account, to strike the balance of interest, and add it to the principal on that side of the account to which the larger amount of interest belongs.

The following is the foregoing account completed in the usual form with interest, except that the interest items to be written in red ink are printed in heavier type :

EXERCISES.

1. What was the net balance of the following account on June 30th, 1882. Interest @ 7% :

DR.	C. W. FRAZEE & Co.	CR.
1882.		1882.
March 8.	To Mdse. \$321.80	April 16. By Cash \$200.00
29.	" " 568.15	June 4. " " 750.00
May 17.	" " 462.45	

2. Find the net balance of the following account on Dec. 31st, 1882. Interest @ 6% :

DR.	C. W. FRAZEE & Co.	CR.
1882.		1882.
June 30,	To Balance \$416.85	Aug. 19. By Cash \$500.00
July 31.	" Mdse. 280.37	Oct. 11. " " 200.00
Sep. 10.	" " 184.28	Dec. 24. " " 100.00
Nov. 21.	" " @ 3m. 572.88	

3. What was the net balance of the following account on Nov 1st, 1882. Interest @ 7% :

JONES, SMITH & Co.

1882.	DR.	
March 3.	To Mdse. @ 3 mos.....	\$263.30
April 15.	" " " 4 "	427.64
May 27.	" " " 6 "	392.16
June 13.	" Cash	200.00
July 5.	" Mdse. @ 2 mos.....	538.10
Sep. 24.	" " " 1 "	195.90
1882.	CR.	
April 10.	By Note @ 2 mos	\$250.00
May 12.	" " " 3 "	440.94
June 13.	" Cash	300.00
	" Note @ 6 mos.....	300.00
Aug. 16.	" Cash.....	120.00

4. What was the net balance of the following account on June 30th, 1882, the mdse. items being on 4 mos. credit, and interest at 6%?

Dr.		W. C. McINNIS & Co.		Cr.	
1881.		1882.			
Dec. 31.	To Balance	\$425.63	Feby. 2.	By Cash	\$300.00
1882.					
Jan. 19.	To Mdse.	148.70	Mar. 3.	" Note @ 2m.	600.00
Feb. 12.	" "	395.50	May 28.	" Cash	500.00
Mar. 3.	" "	738.54	June 18.	" "	380.00
21.	" "	209.60			
April 26.	" "	478.15			
May 13.	" "	571.74			
June 11.	" "	87.40			

5. Find the net balance of the following account on Dec. 31st, 1882, the mdse. items being on 4 mos. credit, and interest at 6%:

Dr.		J. R. STONEMAN.		Cr.	
1882.		1882.			
June 30.	To Bal. net	\$1260.15	Aug. 3.	By Cash	\$750.00
July 16.	" Mdse.	187.90		" Note @ 3m.	750.00
Sept. 11.	" "	416.30	Nov. 30.	" Cash	800.00
Oct. 24.	" "	305.25	Dec. 14.	" Note @ 3m.	800.00
Nov. 6.	" cash pd. note	750.00			
Dec. 14.	" Mdse.	134.70			

6. What will be the net cash balance of the following account on March 25th, 1883. Interest @ 7%?

Dr.		J. C. BAYLIES.		Cr.	
1882.		1882.			
July 4.	To Cash	\$200.00	July 20.	By Cash	\$300.00
Sept. 8.	" "	300.00	Aug. 15.	" "	450.00
25.	" "	250.00	Sept. 1.	" "	400.00
Oct. 1.	" "	600.00	Nov. 1.	" "	320.00
Nov. 20.	" "	400.00	Dec. 6.	" "	600.00
Dec. 12.	" "	500.00	20.	" "	100.00

1883.			1883.		
Jan. 15.	To Cash	\$100.00	Feb. 1.	By Cash	\$200.00
Mar. 11.	" "	120.00	28.	" "	150.09

DISCOUNT AND PRESENT WORTH.

The **Present Worth** of a debt payable at a future time is its value now.

The **Discount** is the difference between the present worth and the debt itself when due ; that is, it is a sum which deducted from the face of the debt will leave the present worth.

Theoretically the discount is the interest of the present worth to the time the debt is payable. This is called **True Discount**. At true discount the **Present Worth** is such a sum as if put on interest to the time the debt is payable would amount to the debt.

The usual problem in true discount is to find the present worth, and thence the discount—the debt, the time it is payable, and the rate of discount being given.

From the above definitions it will be seen that the present worth, expressed in terms of an interest problem, is the principal ; of which the discount is the interest, and the debt the amount. Hence to find the present worth at true discount is the same problem as to find the principal,—the amount, time and rate being given (Case VI. p. 105.) Therefore,

To find the present worth and true discount,

RULE.—*Divide the face of the debt by the amount of \$1 for the given time and at the given rate ; the quotient will be the present worth.*

Subtract the present worth from the face of the debt : the remainder will be the true discount.

EXERCISES.

The current rate of interest being 6%, what are the present worth and true discount of

1. \$224 due 2 years hence ?
2. \$88.16 due 1 y. 8 m. 12 d. hence ?

3. \$145.50 due 2 y. 6 m. 12 d. hence?
4. \$1000 due 3 y. 10 m. hence?
5. \$15000 due 5 y. hence?
6. \$4291.20 due 1 y. 7 m. 22 d. hence?
7. \$600 due 8 m. 5 d. hence?
8. \$1200 due 20 y. hence?
9. At 7%, \$670 due 1 y. 8 m. hence?
10. At 8%, \$501 due 1 y. 5 m. hence?
11. At $7\frac{1}{2}\%$, \$678.75 due 3 y. 7 m. hence?
12. At 6%, \$1060 due 1 year hence?
13. At 6%, \$1060 due 6 months hence?
14. I am offered a quantity of goods for \$2000 cash, or \$2821.50 on 9 months' credit; which is the better bet, and by how much?
15. What is the present worth of a debt of \$24000 to be paid in four instalments as follows: one-fifth in 4 months; one-fourth in 9 months; one-sixth in 1 y. 2 m., and the remainder in 1 y. 7 m.?
16. I am offered on Oct. 3rd, 1882, a good note at 6 months for \$900, dated Aug. 23rd, 1882; how much may I pay for it so as to make 10% per annum interest on my investment?
17. What must I pay on the 15th of August, 1882, for a note for \$746.75, dated Jan. 19th, 1882, payable 1 year after date, with interest at 7%, in order to make at the rate of 30% interest on the money I pay for it?
18. What can I pay on Sep. 21st for a note for \$1250 dated May 31 at 6 months to make at the rate of 20% interest on the investment?

COMPOUND INTEREST.

Compound Interest is interest not only on the principal or original sum, but, after the first period, on the amounts formed by the addition of simple interest at regular intervals. The principal drawing interest during any period therefore is the amount at the end of the preceding period.

The period at the end of which interest is added is usually one year, but it may be 6 months, 3 months, &c., and such period is called the interest period.

Compound interest is not legal interest, and cannot be collected by law; but it is equitable, and when paid does not constitute usury in the eye of the law. It may, of course be obtained by the lender of money collecting his interest at

stated periods and investing it. This being the case the future value of money running over any considerable time is often reckoned to be its amount at compound interest. So also the present value of a given sum payable at a future period is such a sum as, at compound interest, would amount to the given sum at said future period.

Compound interest at 4 per cent. computed annually on June 30, is allowed on deposits in the Government Savings Banks. The calculations in life insurance are made on the basis of compound interest, and so are those of many other monetary institutions, such as loan companies, building societies, &c.

The usual problems in compound interest are to find the amount—the principal, time and rate being given; and to find the principal—the amount, time and rate being given. The latter is equivalent to finding, on the basis of compound interest, the present value of money payable at a future time.

To find the amount of any sum at Compound Interest.

RULE.—*Find the amount of the given principal at simple interest for the first period. Taking this amount as principal find its amount for the second period, and so on to the last period. The amount for the last period will be the amount required. Or,*

Find by this rule, or by the table on page 117 the amount of \$1 for the time and rate, and multiply it by the given principal.

NOTE.—1. When the time is not a multiple of one interest period, find the amount to the end of the last full period, and add to it its interest for the remaining time.

NOTE.—2. For the compound interest subtract the original principal from the amount.

EXAMPLE.—What will \$2000 amount to in 5 years at 6% compound interest?

	OPERATION.
\$2000.	principal.
120.	interest for 1st year.
2120.	amt. at end of 1st year.
127.20	int. for 2nd year.
2247.20	amt. at end of 2nd year.
134.832	int. for 3rd year.
2382.032	amt. at end of 3rd year.
142.922	int. for 4th year.
2524.954	amt. at end of 4th year.
151.497	int. for 5th year.
\$2676.45	Ans.—amt. at end of 5 years.

From which, if the compound interest is required, subtract the original principal, \$2000, and the remainder, \$676.45, is the compound interest for 5 years.

EXERCISES

Find the amount of

- | | | | | |
|-----|--------|----------------|---------------|---------------------------|
| 1. | \$75 | for 2 years | @ 7 per cent. | |
| 2. | \$60 | " 4 " | " 7 " | |
| 3. | \$50 | " 3 " | " 6 " | |
| 4. | \$150 | " 3 " | " 9 " | |
| 5. | \$800 | " 5 " | " 5 " | |
| 6. | \$1000 | " 6 " | " 6 " | |
| 7. | \$1200 | " 7 " | " 6 " | |
| 8. | \$1500 | " 8 " | " 5½ " | |
| 9. | \$2000 | " 9 " | " 4 " | |
| 10. | \$600 | " 10 " | " 4½ " | |
| 11. | \$750 | " 10 y. 7 m. | " 6 " | |
| 12. | \$500 | " 2 years | " 6 " | compounded semi-annually. |
| 13. | \$600 | " 2½ " | " 6 " | " " |
| 14. | \$1000 | " 2 " | " 5 " | " quarterly. |
| 15. | \$460 | " 3y. 4m. 10d. | " 6 " | |
| 16. | \$700 | " 4y. 8m. 12d. | " 6½ " | |
| 17. | \$1860 | " 8 years | " 7 " | |
| 18. | \$500 | " 20 " | " 6 " | |
| 19. | \$1000 | " 50 " | " 3 " | |
| 20. | \$1000 | " 25 " | " 4 " | |
| 21. | \$5000 | " 30 " | " 3½ " | |

Find the compound interest of

- | | | | |
|-----|----------|-------------------|---------------|
| 22. | \$500 | for 5 years | @ 5 per cent. |
| 23. | \$760 | " 4 y. 8 m. 5 d. | " 6 " |
| 24. | \$250.80 | " 6 y. 5 m. 20 d. | " 7 " |
| 25. | \$1000 | " 17 y. 10 m. | " 4 " |

COMPOUND INTEREST.

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TABLE,

SHOWING THE AMOUNT OF ONE DOLLAR AT COMPOUND INTEREST FOR ANY NUMBER OF YEARS, NOT EXCEEDING FIFTY.

No.	2 per cent.	3½ per cent.	4 per cent.	5 per cent.	6 per cent.	7 per cent.
1	1.030 000	1.035 000	1.040 000	1.050 000	1.060 000	1.070 000
2	1.060 900	1.071 225	1.081 600	1.102 500	1.123 600	1.144 900
3	1.092 727	1.108 718	1.124 864	1.157 625	1.191 016	1.225 043
4	1.125 509	1.147 523	1.169 859	1.215 506	1.262 477	1.310 796
5	1.159 274	1.187 686	1.216 653	1.276 282	1.338 226	1.402 552
6	1.194 052	1.229 255	1.265 319	1.340 096	1.418 519	1.500 730
7	1.229 874	1.272 279	1.315 932	1.407 100	1.503 630	1.606 781
8	1.266 770	1.316 809	1.368 569	1.477 455	1.593 848	1.718 186
9	1.304 773	1.362 897	1.423 312	1.551 328	1.689 479	1.838 459
10	1.343 916	1.410 599	1.480 244	1.628 895	1.790 848	1.967 151
11	1.384 234	1.459 970	1.539 454	1.710 339	1.898 299	2.104 852
12	1.425 761	1.511 069	1.601 032	1.795 856	2.012 196	2.252 192
13	1.468 534	1.563 956	1.665 074	1.885 649	2.132 928	2.409 845
14	1.512 500	1.618 695	1.731 676	1.979 932	2.260 904	2.578 534
15	1.557 967	1.675 349	1.800 944	2.078 928	2.396 558	2.759 032
16	1.604 706	1.733 986	1.872 981	2.182 875	2.540 352	2.952 164
17	1.652 848	1.794 676	1.947 901	2.292 018	2.692 773	3.158 815
18	1.702 433	1.857 489	2.025 817	2.406 619	2.854 339	3.379 932
19	1.753 506	1.922 501	2.106 849	2.526 950	3.025 600	3.616 527
20	1.806 111	1.989 789	2.191 123	2.653 298	3.207 135	3.869 084
21	1.860 295	2.059 431	2.278 768	2.785 963	3.399 564	4.140 562
22	1.916 103	2.131 512	2.369 519	2.925 261	3.603 537	4.430 402
23	1.973 587	2.206 114	2.464 716	3.071 524	3.819 750	4.740 530
24	2.032 794	2.283 328	2.563 304	3.225 100	4.048 935	5.072 367
25	2.093 778	2.363 245	2.665 836	3.386 355	4.291 871	5.427 433
26	2.156 591	2.445 959	2.772 470	3.555 673	4.549 383	5.807 353
27	2.221 289	2.531 567	2.883 369	3.733 456	4.822 346	6.213 868
28	2.287 928	2.620 172	2.998 703	3.920 129	5.111 687	6.648 838
29	2.356 566	2.711 878	3.118 651	4.116 136	5.418 388	7.114 257
30	2.427 262	2.806 794	3.243 398	4.321 942	5.743 491	7.612 255
31	2.500 080	2.905 031	3.373 133	4.538 039	6.088 101	8.145 113
32	2.575 083	3.006 708	3.508 059	4.764 941	6.453 387	8.715 271
33	2.652 335	3.111 942	3.648 381	5.003 189	6.840 590	9.325 340
34	2.731 905	3.220 860	3.794 316	5.253 348	7.251 025	9.978 114
35	2.813 862	3.333 590	3.946 089	5.516 015	7.686 087	10.676 581
36	2.898 278	3.450 266	4.103 933	5.791 816	8.147 252	11.423 942
37	2.985 227	3.571 025	4.268 090	6.081 407	8.636 087	12.223 618
38	3.074 782	3.696 011	4.438 813	6.385 477	9.154 252	13.079 271
39	3.167 027	3.825 372	4.616 366	6.704 751	9.703 507	13.994 820
40	3.262 038	3.959 260	4.801 021	7.039 989	10.285 718	14.974 458
41	3.359 899	4.097 834	4.993 061	7.391 988	10.902 861	16.022 670
42	3.460 696	4.241 258	5.192 784	7.761 588	11.557 033	17.144 257
43	3.564 517	4.389 702	5.400 495	8.149 667	12.250 455	18.344 355
44	3.671 452	4.543 342	5.616 515	8.557 150	12.985 482	19.628 460
45	3.781 596	4.702 359	5.841 176	8.985 008	13.764 611	21.002 452
46	3.895 044	4.866 941	6.074 823	9.434 258	14.590 487	22.472 623
47	4.011 895	5.037 284	6.317 816	9.905 971	15.465 917	24.045 707
48	4.132 252	5.213 589	6.570 525	10.401 270	16.393 872	25.728 907
49	4.256 219	5.396 065	6.833 349	10.921 333	17.377 504	27.529 930
50	4.383 906	5.584 927	7.106 683	11.467 400	18.420 154	29.457 025

NOTE.—If each of the numbers in the table be diminished by 1, the remainder will denote the interest of \$1, instead of its amount.

To find the **PRINCIPAL**, the amount at compound interest, time and rate being given.

RULE.—Divide the given amount by the amount of \$1 for the given time and rate.

EXAMPLE.—What principal will amount to \$2315.25 in 3 years @ 5% compound interest?

OPERATION.

$$\begin{array}{r}
 \$1.00 \\
 .05 \\
 \hline
 1.05 \\
 .0525 \\
 \hline
 1.1025 \\
 .055125 \\
 \hline
 1.157625
 \end{array}$$

Amt. of \$1 for 3 y. at 5% 1.157625)2315.250000(2000 Ans.

EXERCISES.

What principal will, at compound interest, amount to

1. \$1685.40 in 2 years @ 6 per cent.
2. \$14802.44 " 10 " " 4 "
3. \$2873.37 " 12 " " 5 "
4. \$51428.59 " 40 " " 6 "
5. \$216.73 " 20 " " 3 "
6. What is the present value of a debt of \$1000 payable at the end of 25 years, money being worth 6%, compound interest?
7. What sum must be invested in the Savings Bank at 4% compound interest on the birth of a child so that when the child becomes of age he may draw \$5000?
8. Suppose a person at the age of 58 has a paid up life insurance policy for \$2000, what is its cash value on the basis of 4% compound interest, his expectancy of life being 15 years?
9. As in the last exercise what should be the cash value of a policy of \$5000 paid up at the age of 65, when the expectancy of life is 11 years?
10. In like manner what should be the cash value of a paid-up policy for \$1000 at the age of 52, when the expectancy of life is 18.82 years?

ANNUITIES.

An **Annuity** is an annual payment continuing for a given number of years, for an uncertain period, as for life, or forever.

An **Annuity Certain** is one that is payable for a definite length of time.

An **Annuity Contingent** is one continuing for an uncertain period, as during the life of a person.

A **Deferred Annuity**, or **Annuity in Reversion** is one that begins at a future time.

An **Immediate Annuity** or **Annuity in Possession**, is one that begins immediately.

An **Annuity Forborne** or **in Arrears** is one the payments of which have not been made when due, but have been allowed to accumulate.

The **Amount**, or **final value** of an annuity is the sum of the amounts of all its payments at compound interest to the end of the annuity.

Thus, the amount of an annuity of \$1 for 5 years at 5% is the sum of the amounts of all its payments at the date for the 5th or last payment, and may be shown as follows :

The amt. of the 1st payment, \$1, for 4 years =							\$1.215506	
"	"	"	2nd	"	"	3	"	\$1.157625
"	"	"	3rd	"	"	2	"	\$1.102500
"	"	"	4th	"	"	1	"	\$1.050000
"	5th payment							\$1.000000

Amount or final value \$5.525631

The **Present Value** of an annuity is such a sum as, at compound interest, would amount, at the end of the annuity, to its final value.

A complete discussion of the subject of annuities would occupy too much space and be too intricate for this work. The chief practical problems, viz. : to find the amount and to find the present

value of an annuity are readily solved by the use of the tables on pages 122 and 123, and exercises for these purposes are all that can be here introduced.

To find the amount of an Annuity in Arrears, at compound interest,

RULE.—Multiply the amount of an annuity of \$1 for the given time and rate (Table p. 122) by the given annuity.

EXAMPLE.—Find the amount of an annuity of \$500 forborne 7 years @ 5%.

OPERATION.

\$8.142008	amt. of an annuity of \$1, per table, p.
500	given annuity.
\$4071.0040	Ans.

EXERCISES.

Find the amount of an annuity of

1. \$600 for 10 years @ 6 per cent.
2. \$1000 " 25 " 5 "
3. \$800 " 40 " 3 "
4. \$750 " 30 " 4 "
5. \$1200 " 50 " 7 "
6. \$325 " 12 " 3½ "

To find the present value of an annuity at compound interest,

RULE.—Multiply the present value of an annuity of \$1 for the given time and rate (Table p. 123) by the given annuity.

EXAMPLE.—What is the present value of an annuity of \$120 to continue for 20 years @ 5 % ?

OPERATION.

\$12.46221	present value of an annuity of \$1, per table p.
120	given annuity.
\$1495.4662	Ans.

EXERCISES.

Find the present value of an annuity of

1. \$3000 for 20 years @ 6 per cent.
2. \$10000 " 30 " " 4 "
3. \$2500 " 50 " " 5 "
4. \$250 " 25 " " 3½ "
5. \$750 " 5 " " 7 "
6. \$1000 " 12 " " 3 "
7. \$22.56 " 20 " " 4 "

When the annuity is in reversion.

RULE.—Find the present value of an annuity of \$1 up to the date of the commencement of the annuity, and also to the date of its termination, and multiply the difference of these values by the number denoting the annuity.

8. Find the present value, at 5%, of an annuity of \$400 to commence 10 years hence, and continue for 20 years.

9. What is the present value, at 6%, of an annuity of \$1000 to commence 5 years hence, and continue for 15 years?

10. Find the present value, at 4%, of an annuity of \$2000 to commence 21 years hence and continue for 36 years?

When the annuity is perpetual, its present value is such a sum as, at the given rate, will produce the annuity as annual interest. Hence the following

RULE: Divide the annuity by the interest of \$1 for 1 year, at the given rate.

11. What is the present value, at 3%, of a perpetual annuity of \$1500?

12. What is the present value, at 6%, of a perpetual annuity of \$100?

13. Find the present value, at 5%, of an annuity of \$1000, to commence 11 years hence, and then continue for ever.

TABLE,

SHOWING THE AMOUNT OF AN ANNUITY OF ONE DOLLAR PER ANNUM, IMPROVED AT
COMPOUND INTEREST FOR ANY NUMBER OF YEARS, NOT EXCEEDING FIFTY.

No	3 per cent.	3½ per cent.	4 per cent.	5 per cent.	6 per cent.	7 per cent.
1	1.000 000	1.000 000	1.000 000	1.000 000	1.000 000	1.000 000
2	2.030 000	2.035 000	2.040 000	2.050 000	2.060 000	2.070 000
3	3.090 900	3.106 225	3.121 600	3.152 500	3.183 600	3.214 900
4	4.183 627	4.214 943	4.246 464	4.310 125	4.374 616	4.439 943
5	5.309 136	5.362 466	5.416 323	5.525 631	5.637 093	5.750 739
6	6.468 410	6.550 152	6.632 975	6.801 913	6.975 319	7.153 291
7	7.662 462	7.779 408	7.898 294	8.142 008	8.393 838	8.654 021
8	8.892 336	9.051 687	9.214 226	9.549 109	9.897 468	10.259 803
9	10.159 106	10.368 496	10.582 705	11.026 564	11.491 316	11.977 989
10	11.463 879	11.731 393	12.006 107	12.577 893	13.180 795	13.816 448
11	12.807 796	13.141 992	13.486 351	14.206 787	14.971 643	15.783 599
12	14.192 030	14.601 962	15.025 805	15.917 127	16.809 941	17.888 450
13	15.617 790	16.113 030	16.626 838	17.712 983	18.882 138	20.140 643
14	17.086 324	17.676 986	18.291 911	19.598 632	21.015 066	22.550 488
15	18.598 914	19.295 681	20.023 588	21.578 564	23.275 970	25.129 022
16	20.156 881	20.971 030	21.824 531	23.657 492	25.670 528	27.888 054
17	21.761 588	22.705 016	23.697 512	25.840 366	28.212 880	30.840 217
18	23.414 435	24.499 691	25.645 413	28.132 385	30.905 653	33.999 033
19	25.116 868	26.357 190	27.671 229	30.539 004	33.759 992	37.378 965
20	26.870 374	28.279 689	29.775 779	33.065 954	36.785 591	40.995 492
21	28.676 486	30.269 471	31.966 202	35.719 252	39.992 727	44.866 177
22	30.536 780	32.328 902	34.247 970	38.506 214	43.392 290	49.005 739
23	32.452 884	34.460 414	36.617 989	41.430 475	46.995 828	53.436 141
24	34.426 470	36.666 528	39.082 604	44.501 999	50.815 577	58.176 671
25	36.459 264	38.949 857	41.645 908	47.727 099	54.864 512	63.249 030
26	38.553 042	41.313 102	44.311 745	51.113 454	59.156 383	68.676 470
27	40.709 634	42.759 060	47.084 214	54.669 126	63.705 766	74.483 823
28	42.930 923	46.290 627	49.967 583	58.402 583	68.528 112	80.697 691
29	45.218 850	48.910 799	52.966 286	62.322 712	73.639 788	87.346 529
30	47.575 416	51.622 677	56.084 938	66.438 848	79.058 186	94.460 786
31	50.002 678	54.429 471	59.328 335	70.760 790	84.801 677	102.073 041
32	52.502 759	57.334 502	62.701 469	75.298 829	90.889 778	110.218 154
33	55.077 841	60.341 210	66.209 527	80.063 771	97.343 165	118.933 425
34	57.730 177	63.453 152	69.857 959	85.066 959	104.183 755	128.258 765
35	60.462 082	66.674 013	73.652 225	90.320 307	111.434 780	138.236 878
36	63.271 944	70.007 603	77.598 314	95.836 323	119.120 867	148.913 460
37	66.174 223	73.457 869	81.702 246	101.628 139	127.268 119	160.337 400
38	69.159 449	77.028 895	85.970 336	107.709 546	135.904 206	172.561 020
39	72.224 233	80.724 906	90.400 150	114.005 023	145.068 458	185.640 292
40	75.401 260	84.550 278	95.025 516	120.799 774	154.761 966	199.635 112
41	78.663 298	88.509 537	99.826 536	127.839 763	165.047 684	214.609 570
42	82.023 196	92.607 371	104.819 598	135.231 751	175.950 645	230.632 240
43	85.483 892	96.848 629	110.012 382	142.993 339	187.507 577	247.776 496
44	89.048 409	101.238 331	115.412 877	151.143 000	199.758 032	266.120 851
45	92.719 861	105.781 673	121.029 392	159.700 156	212.743 514	285.749 311
46	96.501 457	110.484 031	126.870 568	168.685 164	226.508 125	306.751 763
47	100.396 501	115.350 973	132.945 390	178.119 422	241.098 612	329.224 386
48	104.408 396	120.388 297	139.263 206	188.025 393	256.564 529	353.270 093
49	108.540 643	125.601 846	145.833 734	198.426 663	272.958 401	378.999 000
50	112.796 867	130.999 910	152.667 084	209.347 976	290.335 905	406.528 929

PRESENT WORTH OF ANNUITIES.

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TABLE,

SHOWING THE PRESENT WORTH OF AN ANNUITY OF ONE DOLLAR PER ANNUM, TO
CONTINUE FOR ANY NUMBER OF YEARS NOT EXCEEDING FIFTY.

No.	3 per cent.	3½ per cent.	4 per cent.	5 per cent.	6 per cent.	7 per cent.
1	0.970 874	0.966 184	0.961 538	0.952 381	0.943 396	0.934 579
2	1.913 470	1.899 694	1.886 095	1.859 410	1.833 393	1.808 017
3	2.828 611	2.801 637	2.775 091	2.723 249	2.673 012	2.624 814
4	3.717 098	3.673 079	3.629 895	3.545 951	3.465 106	3.387 209
5	4.579 707	4.515 052	4.451 822	4.329 477	4.212 364	4.100 195
6	5.417 191	5.328 553	5.242 137	5.075 692	4.917 324	4.766 537
7	6.230 283	6.114 544	6.002 055	5.786 373	5.582 381	5.389 286
8	7.019 692	6.873 956	6.732 745	6.463 213	6.209 744	5.971 295
9	7.786 109	7.607 687	7.435 332	7.107 822	6.801 692	6.515 228
10	8.530 203	8.316 605	8.110 896	7.721 735	7.360 067	7.023 577
11	9.252 624	9.001 551	8.760 477	8.306 414	7.886 875	7.498 669
12	9.954 004	9.663 334	9.385 074	8.863 252	8.383 844	7.942 671
13	10.634 955	10.302 738	9.985 648	9.393 573	8.852 683	8.357 635
14	11.296 073	10.920 520	10.563 123	9.898 641	9.294 984	8.745 452
15	11.937 835	11.517 411	11.118 367	10.379 658	9.712 249	9.107 898
16	12.561 102	12.094 117	11.652 296	10.837 770	10.105 895	9.446 632
17	13.166 118	12.651 321	12.165 669	11.274 066	10.477 260	9.763 206
18	13.753 513	13.189 682	12.659 297	11.689 587	10.827 603	10.059 070
19	14.323 799	13.709 837	13.133 939	12.085 321	11.158 116	10.335 578
20	14.877 475	14.212 403	13.590 326	12.462 210	11.469 421	10.593 997
21	15.415 024	14.697 974	14.029 160	12.821 153	11.764 077	10.835 527
22	15.936 517	15.167 125	14.451 115	13.163 008	12.041 582	11.061 241
23	16.443 608	15.620 310	14.856 842	13.488 574	12.303 379	11.272 187
24	16.935 542	16.058 368	15.246 963	13.798 642	12.550 358	11.469 334
25	17.413 148	16.481 515	15.622 060	14.093 945	12.783 356	11.653 583
26	17.876 842	16.890 352	15.982 769	14.275 185	13.003 166	11.825 779
27	18.327 031	17.285 365	16.320 586	14.643 034	13.210 534	11.986 709
28	18.764 108	17.667 019	16.663 063	14.898 127	13.406 164	12.137 111
29	19.188 455	18.035 767	16.983 715	15.141 074	13.590 721	12.277 674
30	19.600 441	18.392 045	17.292 033	15.372 451	13.764 831	12.409 041
31	20.000 428	18.736 276	17.588 494	15.592 811	13.929 086	12.531 814
32	20.338 766	19.068 865	17.873 552	15.802 677	14.084 043	12.646 555
33	20.765 792	19.390 208	18.147 646	16.002 549	14.230 230	12.753 790
34	21.131 837	19.700 684	18.411 198	16.192 204	14.368 141	12.854 009
35	21.487 220	20.000 661	18.664 613	16.374 194	14.498 246	12.947 672
36	21.832 252	20.290 494	18.908 282	16.546 852	14.620 987	13.035 208
37	22.167 235	20.570 525	19.142 579	16.711 287	14.736 780	13.117 017
38	22.492 462	20.841 087	19.367 864	16.867 893	14.846 019	13.193 473
39	22.808 215	21.102 500	19.584 485	17.017 041	14.949 075	13.264 928
40	23.114 772	21.355 072	19.792 774	17.159 086	15.046 297	13.331 709
41	23.412 400	21.599 104	19.993 052	17.294 368	15.138 016	13.394 120
42	23.701 359	21.834 883	20.185 627	17.423 208	15.224 543	13.452 449
43	23.981 902	22.062 689	20.370 795	17.545 912	15.306 173	13.506 962
44	24.254 274	22.282 791	20.548 841	17.662 773	15.383 182	13.557 908
45	24.518 713	22.495 450	20.720 040	17.774 070	15.445 832	13.605 522
46	24.775 449	22.700 918	20.884 654	17.880 067	15.524 370	13.650 020
47	25.024 708	22.899 438	21.042 936	17.981 016	15.589 028	13.691 608
48	25.266 707	23.091 244	21.195 131	18.077 158	15.650 027	13.730 474
49	25.501 657	23.276 564	21.341 472	18.168 722	15.707 572	13.766 799
50	25.729 764	23.455 618	21.482 185	18.255 925	15.761 861	13.800 746

COMMERCIAL PAPER.

The most usual forms of commercial paper are notes, drafts and bills of exchange.

A **Note**, or as it is often called, a **Promissory Note**, is an absolute promise in writing to pay a specified sum at a specified time, or at sight, or on demand, to a person named in the note, or to his order, or to bearer.

FORM OF PROMISSORY NOTE.

\$147 ⁰⁰/₁₀₀.

HALIFAX, N. S., Nov. 22, 1882.

Three months after date, for value received, I promise to pay Frazee & Whiston, or order, one hundred and forty-seven dollars, sixty-five cents.

JOHN B. PAYSON.

The **original parties** to a note are two—the **Maker** and the **Payee**.

The **Maker** is the party who signs the note. He is sometimes called the promisor. The maker of the above note is John B. Payson.

The **Payee** is the party to whom the money is promised to be paid. He is sometimes called the promisee. In the above note the payee is Frazee & Whiston.

The **Holder** of a note is one who lawfully has possession of it, and is entitled to receive payment. The first holder is usually the payee.

The **Face** of a note is the sum for which it is given.

The **Maturity** of a note is the time at which it is payable, and this in Canada, and most other places, is the third day after the expiration of the time mentioned in the note. These three days are called **days of grace**.

When the last day of grace is Sunday, or a legal holiday, the note is payable on the first business day thereafter.

The words, "for value received," are an acknowledgment on the part of the maker, that he has received value or consideration for the promise given. A note is good without these words, for the law presumes that value was given until it is shown to the contrary. These words are, however, usual in notes and bills, and they may be inserted wherever the sense will admit them.

The words "or order," in a note or bill, make the instrument negotiable, that is, these words enable the original holder of the note absolutely to sell it to another, so that it will become as much the property of that other as it was of the original owner.

When the holder of a note or bill, with the words "or order" in it, transfers it to another, he writes his name on the back of it, which act is called **endorsement**, and it is a guarantee that the note will be paid at its maturity. A person who endorses a note is called an **endorser**.

The expression, "to the order of (the payee)," is often used, instead of "(the payee) or order." The two expressions are practically the same.

If the words "or bearer" were used, instead of the words, "or order," the note would be transferable without endorsement, and would be payable to any legal holder.

DEMAND NOTE.

\$120.00

HALIFAX, Nov. 23rd, 1882.

On demand, I promise to pay John Smith, or order, for value received, one hundred and twenty dollars.

R. J. McLEOD.

This note is payable when the demand for payment is made, and if not then paid, would draw interest at the legal rate thereafter till paid.

NOTE WITH INTEREST.

\$325.²⁵/₁₀₀

HALIFAX, Nov. 23rd, 1882.

One year after date, for value received, we promise to pay to the order of Victor G. Frazee, three hundred and twenty-five and ²⁵/₁₀₀ dollars, with interest at 7 per cent.

NEWMAN CASEY & Co.

This note bears interest at 7% from its date till paid. If the words "at 7%" were omitted, it would bear interest at the legal rate, 6%, from its date till paid. If no mention of interest is made in a note, it bears none until after maturity; after that at 6%. When a note is not to bear interest before maturity, but after that, if not paid, at any other rate than 6%, the words "with interest after maturity at" (whatever rate is agreed upon), must be inserted.

A JOINT AND SEVERAL NOTE.

\$600.00.

HALIFAX, Oct. 31st, 1882.

Four months after date, for value received, we, jointly and severally, promise to pay James Northcote, or order, six hundred dollars.

ARTHUR CRAWFORD,
C. WESTON FRAZEE.

For the payment of the above note, the makers may be sued jointly, and if necessary, each one separately. If the words "jointly and severally" were omitted they would be liable jointly, but not separately.

The four months mentioned expire on the last day of February, 1883, and the note is payable on the third day thereafter—March 3rd. This note would mature on the same day, whether dated October 28th, 29th, 30th, or 31st, as the four months would expire in either case on the 28th or last day of February.

A Bill of Exchange is a written *order*, whereby one person orders another to pay to a third, or his order, or to bearer, a sum of money at a certain time.

The parties to a bill of exchange are three,—the **drawer**, or the person who gives the order; the **drawee**, or the person who is ordered to pay the money; and the **payee**, or the person to whom the money is ordered to be paid.

When the drawer and the drawee are both residents of the same country, the bill is called an inland bill, or more commonly a **draft**.

When the drawer and the drawee are residents of different countries, the bill is called a foreign bill, and this is what is commonly meant by the term "bill of exchange."

Drafts and bills of exchange are made payable "at sight," that is, on presentation, or at a specified time after sight, or at a specified time after date, or on demand.

A draft or bill of exchange is **accepted** when the drawer undertakes to do what he is ordered to do, and he does this by writing the word "accepted" across the face of the bill, followed by the date, if the bill is payable after sight, and his signature. He is then called the **acceptor**.

When a bill or draft is made payable a certain time after sight, the time is counted from the date of acceptance. When a certain time after date, the time is counted from the date of the instrument.

All drafts and bills, except those to be paid "on demand," are subject to three days of grace, if the words without grace are not inserted. Demand drafts are payable when the demand for payment is made.

A SIGHT DRAFT.

\$400.00.

HALIFAX, Nov. 20th, 1882.

At sight, pay to the order of Hiram Dodge, four hundred dollars, value received.

FRAZEE & WHISTON.

To DODDRIDGE DWYER, *Pictou*.

TIME DRAFT.

\$1000.

HALIFAX, Nov. 25th, 1882.

Thirty days after sight (or date), pay to the order of Brown & Jones, one thousand dollars, value received, and charge to the account of

FRAZEE & WHISTON.

To JNO. W. SMITH & Co, *Montreal*.

Foreign bills, that is, bills drawn in Canada and payable in Great Britain or any foreign country, are (except those on the United States) usually drawn in sets of two or three, one of which being honored the others are void. Bills on the United States, though they are foreign bills, are drawn singly in the same form as inland bills, and are called drafts.

A SET OF STERLING EXCHANGE.

£240 12s. 9d.

HALIFAX, N. S., Nov. 25th, 1882.

Sixty days after sight of this, our first of exchange (second and third of the same date and tenor unpaid) pay to the order of John B. Cummings two hundred and forty pounds, twelve shillings and ninepence, value received, and charge to the account of

To H. B. GLADSTONE, *London.*

FRAZEE & WHISTON.

£240 12s. 9d.

HALIFAX, N. S., Nov. 25th, 1882.

Sixty days after sight of this our second of exchange (first and third of the same date and tenor unpaid) pay, &c.

£240 12s. 9d.

HALIFAX, N. S., Nov. 25th, 1882.

Sixty days after sight of this, our third of exchange (first and second of the same date and tenor unpaid), pay, &c.

BANK DISCOUNT.

A large part of the business of banks consists in **discounting** notes and bills, that is, purchasing notes and bills from merchants and others, paying for each a sum equal to its face, less the interest on the same for the number of days it has to run after the day of purchase. Such interest is called the **discount**, and the remainder, when the discount is subtracted from the face of the note, is called **present worth**, **proceeds** or **avails**.

All **endorsers** of a note or bill, that is, all persons whose names appear on the back of it at the time of its maturity, and also the **drawer** of a bill, are separately liable for its payment, if the maker or acceptor does not pay it, provided they are legally notified of its dishonor.

Thus the business of discounting notes is a system of loaning money in which the banks hold for the repayment of the loans, not only the persons to whom the loans are made, but all the parties to the notes discounted.

To find the discount, and thence the proceeds of a note or bill, when discounted at a bank.

RULE.—Find the number of days from the day the note is discounted to the day on which it is to be paid, and compute the interest for that time on the face of the note or bill. This interest is the discount.

Subtract the discount from the face of the note or bill for the proceeds.

NOTE.—When the last day of grace of a note or bill falls on Sunday or a legal holiday, one more day is added to the time; and in case a Sunday and a holiday come together, and the last day of grace occurs on the first of such days, two more days are added to the time, because in such a case the note cannot be collected till the first business day after the Sunday or holiday.

EXAMPLE.—What were the proceeds of a note for \$400, dated December 12th, 1882, at 3 months, when discounted at a bank on January 3rd, 1883, @ 7 %?

This note was payable March 15th, 1883, that is, on the last day of grace. The number of days from January 3rd, the day the note was discounted, to March 15th, is 71. The interest of \$400 for 71 days @ 7 % is \$5.44, which is the discount. Then \$400—\$5.44=\$394.56, which is the proceeds.

Find the discount and proceeds of the following:—

Face of Note.	Date.	Time.	When discounted.	Rate.
1. \$700	Jan. 6, '83.	3 mos.	Jan. 6, '83	6%
2. \$455.80	Aug. 14.	4 "	Aug. 14	7%
3. \$1200	Dec. 30, '81.	2 "	Jan. 12, '82	7%
4. \$639.25	Oct. 31, '79.	4 "	Dec. 24, '79	8%
5. \$510	March 31.	6 "	April 20	6%
6. \$128.50	Sept. 19.	60 days.	Sept. 19	6%
7. \$293.18	Sept. 28	60 "	October 3	6%
8. \$427	Jan. 8, '82.	90 "	March 1	7%
9. \$96.75	June 24.	30 "	June 28	8%
10. \$1000	Dec. 31, '83.	2 mos.	Jan. 18, '84	9%

11. On Jan. 9th, 1883, a merchant sold 240 bales of cotton, each weighing 280 pounds, at $12\frac{1}{2}$ cents per pound, which cost him, the same day, 10 cents per pound; he received in payment a good note, at 4 months, which he discounted immediately at a bank at 7 per cent.; what were his profits?

12. I hold a note against Clemea, Rice & Co., to the amount of \$327.40, dated April 11th, 1883, at six months, and drawing interest at the rate of 6 per cent. per annum. What are the proceeds if discounted at the People's Bank on the 10th of August, at 7 per cent.?

NOTE.—When a note drawing interest is discounted at a bank, the interest is calculated on the face of the note from its date to the time of maturity, and added to the face of the note, and this amount is discounted for the length of time the note has to run.

13. What will be the discount on the following note if discounted at a bank on the 17th of November, at 6 per cent.?

\$527. $\frac{21}{100}$

HALIFAX, N. S., Oct. 4th, 1882.

Ninety days after date, for value received, we promise to pay to the order of Smith, Warren & Co., five hundred and twenty-seven and $\frac{21}{100}$ dollars at the Merchants' Bank, with interest at eight per cent.

THOMPSON & BURNS.

14. What was the discount at $7\frac{3}{8}$ per cent. on a note for \$227.41, drawing interest at 8 per cent., dated May 1st, 1882, at one year after date, if discounted on March 7th, 1883?

15. What amount of money should I receive on the following note, if discounted at a bank on June 20th, at 9 per cent.?

\$473.80.

ST. JOHN, May 17th, 1882.

Three months after date I promise to pay to the order of J. R. Sing & Co., four hundred and seventy-three and $\frac{80}{100}$ dollars, at the + Maritime Bank, St. John, for value received, with interest, at $7\frac{3}{8}$ per cent.

RICHARD DUNN.

16. What must I pay for the following note on August 15th, 1883, so as to make at the rate of 30 per cent. interest per annum on the money I pay for it?

\$746.75.

WINDSOR, January 19th, 1883.

One year from date, for value received, we promise to pay Jas. Ames, or order, seven hundred and forty-six $\frac{75}{100}$ dollars, at the Commercial Bank, Windsor, with interest at $7\frac{3}{10}$ per cent. per annum.

WILSON & CUMMINGS.

17. A holds a note against B for \$478.92, dated May 10th, 1883, at one year after date, drawing $7\frac{3}{10}$ per cent. interest. I purchase this note from A on August 18th following, paying for it such a sum as will allow me 20 per cent. interest on my money. What do I pay for it?

To find the face of a note such that, when discounted at a bank, its proceeds shall be a given sum.

RULE.—Divide the given sum by the proceeds of \$1 for the given time and rate. The quotient will be the face of the note.

NOTE.—This is the same as Case II, page 88, with the element of time added.

EXAMPLE.—What must be the face of a note dated Jan. 6th, 1883, at three months, to be worth, on the same day, \$400—bank discount at 7%?

OPERATION.

Time is 93 days.

The interest of \$1 for 93 days @ 5 % is $\frac{2}{3}$ of a cent, and @ 7 % is $\frac{1}{2}$ of $\frac{2}{3}$ of a cent = $\frac{1}{3}$ of a cent = \$.01 $\frac{333}{1000}$. Then,

$$\begin{array}{r} \$1.00 \\ .01\frac{333}{1000} \\ \hline \end{array}$$

Proceeds of \$1.00, $.98\frac{7}{10}$) 400 (407.26, that is, \$407.26, the face of the note required.

NOTE.—Since \$400 is the proceeds of a note, the face of that note must contain \$1 as often as \$400 contains the proceeds of \$1.

Or, the following method may be used :—

RULE.—*Find the interest of the given sum for the given time, at the given rate; then the interest of that interest, and so on, till the interest of the last interest obtained is less than a cent, that is, insignificantly small. Add the successive items of interest thus found to the given sum for the face of the note required.*

EXAMPLE.—Taking the same problem as before, the interest of \$400, for 93 days at 7% is \$7.13, and the interest of \$7.13, for the same time, at the same rate is 13 cents, while the interest of 13 cents is practically nothing, being less than half a cent. Then $\$400 + \$7.13 + \$.13 = \$407.26$, the answer as before.

NOTE.—The last method, though not theoretically correct, is practically so, and with the aid of interest tables may be readily used with results sufficiently accurate for business purposes.

EXERCISES.

1. For what sum must a note be given so as to produce a net sum of \$375, when discounted at a bank for 95 days at 6%?
2. A man owes you \$750 now due; for how large a sum should he give you his note to be discounted at a bank for 184 days at 7%, and yield the net amount of the debt?
3. Your note for \$800 lies at the College Bank, due on the 8th January, 1883; what is the face of a renewal in full for 2 mos., bank discount at 7%?
4. Your note for \$1200 is due at a bank on March 28. You pay \$500 cash, and renew for 4 months for the balance; what is the face of the renewal note,—bank rate 8%?
5. On May 15th a merchant bought a quantity of goods for \$600; for what sum should he write his note at 6 months to be discounted at 6%, and pay the debt?
6. If a merchant wishes to obtain \$550 from a bank, discounting at $7\frac{1}{2}\%$, for what sum must he give his note at 60 days?

7. I sold A. Mills merchandise to the amount of \$918.16, for which he was to pay me cash ; but being disappointed in receiving money expected, he gave me his note at 90 days for such a sum as when discounted at 7%, produced the price of the merchandise. What was the face of the note ?

8. I owe R. Harrington an *acct.*, now due, of \$168.45 ; he also holds a note against me for \$210, which will be due in 34 days, including days of grace ; he allows me a discount of 8% on the note, and takes a new note at 60 days large enough to settle, when discounted at a bank at 6%, both debts. What is the face of the new note ?

9. Samuel Johnson has been owing me \$274.48 for 84 days. I charge him interest at 6% per annum for this time, and he gives me his note, at 90 days, so that when I get the note discounted at 8%, the proceeds will equal the amount due. What is the face of the note ?

10. I got my note for \$2000 discounted at a bank, May 20, 1882, at two months, and immediately invested the sum received in flour. June 7, 1882, I sold half the flour at 10 per cent. less than cost, and put the money on interest at 9 per cent. August 13, 1882, I sold the remainder of the flour at 18 per cent. advance, and expended the money for cloth at \$1 per yard ; 12 days after I sold the cloth at \$1.16 $\frac{2}{3}$ per yard, receiving half the price in cash, which I lent on interest at 7 $\frac{1}{2}$ per cent., and a note for the other half, bearing interest from October 4, 1882, at 6 $\frac{3}{4}$ per cent. When my note at the bank became due I renewed it for 5 months, and when this note became due I renewed it for 2 months, and when this note became due I renewed it for such a time that it became due July 20, 1883, at which time I collected the amounts due me, and paid my note at the bank. Required the loss or gain by the transaction.

PARTIAL PAYMENTS.

It is often required to find the balance due on a note, mortgage, or other interest bearing obligation where part payments have been

made at various times, and no other settlements arrived at than the endorsement on the instrument of the sums paid, or receipts given on account.

The usual course, in such cases, is to apply the payment, or so much of it as is necessary to the discharge of the interest due at the time the payment is made, and the balance, if any, to the discharge of the principal. If the payment is not sufficient to pay the interest then due, the balance of interest must not be added to the principal for the purpose of charging interest thereon, for that would be charging interest on interest, which, in general, is not allowable.

To carry out the above adopt the following

RULE.—Find the amount of the principal to the time of the first payment, if that payment exceeds the interest due at that time; if not then to the time when the sum of the payments exceeds the interest, and subtract the payment, or the sum of the payments from such amount. Consider the remainder as a new principal, and proceed as before with other payments, and so on, to the time of settlement.

EXAMPLE.—Find the balance due on the following note on December 31st, 1882 :—

\$1600.

PICOTU, Feb. 16th, 1880.

On demand I promise to pay Jacob Anderson, or order, one thousand six hundred dollars, with interest at 7 per cent.

JOHN FORTUNE, JR.

There was paid on this note,—

June 19th, 1880.....	\$460
January 22, 1881	150
February 25, 1881.....	50
May 10, 1882.....	100
November 4th, 1882	700

PARTIAL PAYMENTS.

135

OPERATION.	
Principal	\$1600.00
Interest from Feb. 16, '80, to June 19, '80—124 days, add	38.07
Amount June 19, '80	1638.07
First payment—subtract	460.00
Balance—new principal	1178.07
Int. from June 19, '80, to Jan. 22, '81—217 days, add	49.03
Amount January 22, '81	1227.10
Second payment	150.00
Balance—new principal	1077.10
Interest from Jan. 22, '81, to Feby. 25, '82—399 days	82.42
Interest on same principal from Feby. 25, '82, to May 10, '82—74 days	15.29
Amount May 10, '82	1174.81
Third and fourth payments	150.00
Balance—new principal	1024.81
Interest from May 10, '82, to Nov. 4, '82—178 days	34.98
Amount Nov. 4, '82	1059.79
Fifth payment	700.00
Balance—new principal	359.79
Interest from Nov. 4, '82, to Dec. 31, '82—57 days...	3.93
Amount Dec. 31, '82—balance due	363.72

EXEROISES.

1. How much remained due on the following note on June 12th, 1883:—

\$800.00.

HALIFAX, N. S., Oct. 21st, 1880.

One year after date, for value received, I promise to pay Smith & Hunter, or order, eight hundred dollars, with interest.

L. J. McLEOD.

Payments:—

October 21st, 1881	\$300
March 1st, 1882	100
November 16th, 1882	150
February 27th, 1883	80

2. What was the balance of the following note on April 5th, 1880 :—

\$350.00

WINDSOR, N. S., May 1st, 1876.

On demand I promise to pay William Brown, or order, three hundred and fifty dollars, with interest.

JAMES WESTON.

Payments :—

December 25th, 1876	\$50
June 30th, 1877	5
August 22, 1878	15
June 4th, 1879	100

3. Find the balance due on the following note on December 19th, 1885 :—

\$609.00

KENTVILLE, N.S., June 8th, 1881.

Six months after date, we jointly and severally, promise to pay John Anderson, or order, six hundred and nine dollars, sixty-five cents, with interest after maturity, at 7 per cent.

SAMUEL GRAHAM,
T. B. BEARMAN.

Payments :

October 4th, 1882	\$25.00
March 15th, 1883	160.00
August 24th, 1884	50.00

4. Note for \$874.95, dated May 9th, 1879, at 3 months, to bear interest after maturity at 6 per cent.

Payments :—

April 12th, 1880	\$156.30
July 14th, 1881	25.00
Sept. 18, 1882	240.00

How much was due March 1st, 1883 ?

5. On January 4th, 1881, a note was given for \$800, payable on demand, with interest at 7%. The following payments were receipted on the back of the note :—

February 7th, 1881.....	\$150
April 16th, 1881.....	100
September 30th, 1881.....	180
January 4th, 1882	170
March 24th, 1882	100
June 12th, 1882	50

Settled July 1st, 1883. How much was due ?

6. A mortgage for \$2500 was given on April 25th, 1875, and drew interest from that date at 6 per cent.

The following payments were made as per receipts endorsed on the mortgage :

Oct. 31, '75.....\$ 98.00	Dec. 9th, '75.....\$102.00
April 14th, '76..... 40.00	June 19th, '76..... 240.00
Dec. 1, '76	Feb. 23rd, '77..... 400.00
Feb. 8th, '78..... 100.00	April 2nd, '78..... 100.00
May 18, '78	Jan. 4th, '79..... 200.00
July 3, '79..... 100.00	July 27, '79..... 196.17

How much remained due Sept. 25th, 1879 ?

MERCHANTS' RULE.

It is customary among merchants where partial payments have been made on notes and other debts, especially where the note or debt is settled within a year from the time of becoming due to consider the note or debt as one side of an account, and the payments as the other side, and settle as an account current with interest. This method is more favorable to the debtor than the foregoing, and where the payments are frequent it would seem to be more equitable.

RULE.—*Find the amount of the principal from the time it became due to the time of settlement. Then find the amount of each payment from the time it was paid to the time of settlement, and subtract their sum from the amount of the principal.*

EXAMPLE.—How much was due on Dec. 31st., 1882, on a note for \$600 dated January 2nd, 1882, payable on demand with interest at 6%, on which the following payments had been made :

March 14	\$120
June 20	150
Sept. 9	200

OPERATION.

Principal	\$600.00
Interest from Jan. 2nd to Dec. 31—363 days.....	35.81
Amount of principal to Dec. 31	<u>\$635.81</u>
1st payment.....	\$120.00
Interest from March 14 to Dec. 31—292 days....	5.76
2nd payment.....	150.00
Int. from June 20 to Dec. 31—194 days.....	4.78
3rd payment.....	200.00
Int. from Sept. 9 to Dec. 31—113 days.....	<u>3.71</u>
Amt. of payments—subtract	<u>\$484.25</u>
Bal due Dec. 31, '82.....	<u>\$151.56</u>

EXERCISES.

7. How much was due on the following note on December 28th, 1882?

\$400.00.

MAITLAND, N. S., January 1st, 1882.

For value received, I promise to pay J. B. Smith & Co., or order, on demand, four hundred dollars, with interest at 6 per cent.

A. R. CASSELS.

The following payments were receipted on the back of this note

February 4th, 1882, received	\$100
May 16th, " "	75
August 28th " "	100
November 25th, " "	80

8. What remained due on the following note on May 6th, 1883 :

\$950.00.

DARTMOUTH, Jan. 3rd, 1881.

Two years after date I promise to pay A. R. Tennison or order, nine hundred and fifty dollars, with interest at seven per cent.

JAS. S. PARMENTER.

Payments :

Feb. 1st, 1882	\$500
Nov. 14th, "	100
Jan. 12th, 1883	300

9. What was due on the following note on August 7th, 1883 :

\$240.00.

HALIFAX, May 4th, 1882.

Three months after date I promise to pay A. K. Frost & Co., or order, two hundred and forty dollars. Value received.

DAVID FLOEK.

Payments :

Sept. 10th, 1882	\$60
Jan. 16th, 1883	90

10. How much was due on the following note at the time of settlement—Aug. 10th, 1883:—

\$340.75.

ANTIGONISH, June 16th, 1882.

Three months after date, for value received, I promise to pay D. Graham Whidden, or order, three hundred and forty dollars and seventy-five cents with interest at 7 per cent.

WILLIAM J. PUGH.

Payments :

October 14th, 1882	\$86
Feb. 12th, 1883	40
May 27th, 1883	90

COMMISSION AND BROKERAGE.

DEFINITIONS.

A **Commission Merchant** is one who sells, usually in his own name, goods intrusted to him for that purpose by others. He is sometimes called a factor.

A **Broker** is one who makes contracts in the names of those who employ him, but who does not have possession of the property he buys or sells.

Commission merchants and brokers are agents, and the parties for whom they act are the principals.

Commission and **Brokerage** are the charges made by these agents for transacting business for others. It is usually computed at so much per cent. of the outlay in case of buying, or, of the gross amount of the sales in case of selling.

A **Consignment** is a quantity of goods sent or consigned by one person to another. The party who sends it is the **Consignor**, and the party to whom it is sent is the **Consignee**.

The **Gross Proceeds** of a consignment are the total amount realized by the sale of the goods.

The **Net Proceeds** are what remains of the gross proceeds after all expenses and charges have been deducted.

An **Account Sales** is a detailed statement of the sales, expenses and charges of a consignment.

ACCOUNT SALES.

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ACCOUNT SALES.

HALIFAX, N. S., April 1st., 1883.

*Sold for Account of Jas. Smith & Co.**By Frazee & Whiston.*

Mar.	3	5 boxes Soap, A. No. 1, \$3.00...	15 00		
	10	10 " " "The Thistle," 2.75.	27 50		
	18	736 lbs. Butter, 18c.	132 48		
	30	5 boxes Soap, A. No. 1, 3.00...	15 00		
				189	98
		CHARGES.			
Mar.	1	Freight ex. Rail.	3 90		
		Express from Depot.	50		
	30	Commission, 5%.	9 50		
				13	90
		Net Proceeds.		\$176	08

An **Account Purchase** is a detailed statement of the cost of goods purchased for another, and the expenses and charges attending the purchase.

ACCOUNT PURCHASE.

TORONTO, Nov. 30th, 1882,

*Purchased by W. C. Douglas,**For acct. and risk of Frazee & Whiston.*

	100	bbls. "Major," @ \$6.50.	650 00		
	100	" " "Walzen," @ 7.25....	725 00		
	250	" " "White Swan," @ 5.80	1450 00	2825	00
		CHARGES.			
		Cartage.	8 25		
		Commission @ 1½% on \$2833.25.	42 50	50	75
		Charge your Acct.		2875	75

EXERCISES.

1. An agent sold for a manufacturer agricultural implements for \$1875.75; what was his commission at $2\frac{1}{2}\%$?
2. Bought 25 chests of Tea, averaging 64 lbs. each, @ $37\frac{1}{2}$ cents per lb., on commission @ $1\frac{1}{2}\%$; what was my commission?
3. My correspondent purchased for me 2768 lbs. Bacon, @ $12\frac{1}{2}$ cents per lb.; what was his commission at $3\frac{1}{4}\%$?
4. A salesman sells on a commission of $2\frac{1}{2}\%$; what must be his annual sales that he may have a yearly income of \$2500?
5. A lawyer collected debts to the amount of \$3275 on a commission of 5% ; how much should he pay over to his principal?
6. My Agent in Toronto buys for me, on commission, @ $2\frac{1}{2}\%$, 750 bbls. flour @ \$5.10 per bbl.; how much do I owe him?
7. A collecting agent collected \$2875, and paid over \$2807.38, retaining the difference as his commission; what was the rate charged?
8. Remitted an agent in Montreal \$988, which paid for a purchase of flour, and his commission @ 4% ; what was the cost of the flour, and what was his commission?
9. An agent purchased wheat on commission @ $2\frac{1}{2}\%$, and received from his principal in full for the wheat and his commission \$779; what did the wheat cost, and what was the agent's commission?
10. Remitted a commission merchant at Brantford \$3641.40 to invest in flour, and to pay his commission @ 2% on the sum invested; how many barrels of flour would he purchase @ \$4.25 per bbl.?
11. What would be the net proceeds of sales of mdse. amounting in gross to \$4825.90, the charges being: for transportation \$105.28, for advertising \$12.50, for storage \$19.20, and for commission $2\frac{1}{2}\%$?
12. An agent sold 84 sewing machines @ \$25.00 each, and his commission was \$262.50; at what rate was he paid?
13. A book agent sold books for Day & Co., Montreal for \$487.60, and received \$73.14; what was the rate of his commission?

14. An English commission agent buys for a Halifax house goods to the value of £576.10s.; what is his commission in sterling @ $4\frac{1}{2}\%$?

15. What is the commission in sterling @ $7\frac{1}{2}\%$ on a purchase of £534.4s. worth of goods?

16. An English commission agent sold cattle for a Canadian exporting firm to the amount of £1325.18s. 9d., and his commission was £66 5s. 11 $\frac{1}{2}$ d.; what was the rate per cent?

17. J. Flemming, Hamilton, purchased for me a lot of butter, at 25 cents per lb., his bill for which, together with his commission, @ $1\frac{1}{2}\%$, amounted to \$779.52. How many lbs. of butter should I have received, and what was his commission?

18. Graham Bros. purchase for me bacon and hams, for which they pay \$1560, and charge $5\frac{1}{2}\%$, and the charge for lading is \$75.15. How much do I owe them?

19. My agent in Toronto bought for me 276,448 centals of wheat @ \$2.245 per cental. What was his commission at $\frac{1}{2}\%$?

20. An auctioneer having sold a lot of furniture on commission @ $3\frac{1}{2}\%$, paid his principal \$2393.20. What did his commission amount to?

21. I remit J. Purdy, New Orleans, \$1142.40, instructing him to invest in cotton, which he does, at 16 cents per lb., retaining his commission on the investment @ 2% . How many lbs. of cotton should I receive?

22. Morrison & Thomson have sold for me 112 bbls. of fish @ \$9.50 per bbl., and 85 bbls. flour @ \$12.40, commission at $2\frac{1}{2}\%$. I have instructed them to invest the net proceeds in bacon. They charge $1\frac{1}{2}\%$ for investing, and pay $13\frac{1}{2}$ cents a pound for the bacon. How many lbs. of bacon should I receive, and what is the total amount of their commission?

23. An accountant being employed to make schedules of the liabilities and assets of a bankrupt, charges $2\frac{1}{2}\%$ on the former, and $5\frac{1}{2}\%$ on the latter. How much does he get altogether, the liabilities being \$2786, and the assets \$618?

24. A broker received \$36 for selling bonds @ $\frac{1}{2}\%$ brokerage on the par value. What was the value of the bonds sold?

25. A commission merchant sold 255 bales of cotton, averaging 460 lbs. per bale, @ 16.3 cents, on commission @ $1\frac{1}{4}\%$, other charges amounting to \$242.50. He purchased for his consignor 720 quintals dried fish @ \$2.75 per quintal, and 1500 bbls. pickled fish @ \$4.30 per barrel, charging 3%. How much is still due the consignor?

26. A Montreal merchant shipped a commission merchant in New Orleans 8000 bush. wheat and 600 bbls. flour, with instructions to sell and invest the proceeds in sugar. The wheat was sold @ \$1.55 per bush., and the flour @ \$5.20 per bbl. The freight, cartage, &c., amounted to \$2430, and the commission for selling was @ $2\frac{1}{2}\%$ for the flour, and 1 cent per bush. for the wheat. How many lbs. of sugar could be purchased @ $6\frac{1}{4}$ c. per lb., the commission for the purchase being @ 3%?

STOCKS AND BONDS.

DEFINITIONS.

A **Joint Stock Company** is an association of individuals with a joint capital contributed by the members of the company, who are empowered by act of parliament to act as one person in the prosecution of business enterprises.

The capital of such a company is called its **Capital Stock**, or more generally **Stock**. It is usually divided into shares, each share representing a specified portion of the capital, and a person subscribing this specified sum, or any multiple of it becomes a shareholder or stockholder with one or more shares according to the sum he subscribes.

A **Stock Certificate** is a written instrument signed by the proper officers of the Company certifying that the person to whom it is issued is the owner of a certain number of shares of its capital stock.

Preferred or Preferential Stock is stock taking preference of the ordinary stock of a Company. Preferred stock is often issued where additional capital which cannot be otherwise raised is necessary to the success or existence of a company; as when a company becomes embarrassed, and would otherwise lose its property, or is unable to profitably carry on its business for want

of sufficient capital. A stipulated dividend must be paid to the holders of preferred stock, before the holders of ordinary stock are entitled to anything.

The **par value** of a share is the sum which each share originally represented, and is often \$100 for the sake of convenience, but may be any sum the projectors of the company choose to make it.

A **Dividend** is the whole or part of the profits of a company during a given time which are *divided* among, and paid to, the shareholders.

The stock of a company is desirable or otherwise according as the dividends are large or small, or none. When the dividends are large the stock is in demand, and the price rises above the par, or original value, and is then said to be at a premium. When there are no dividends, or when they are very small, the stock is not sought after, while those who hold it are likely to want to sell. Then the price falls below the par value, and is said to be at a discount.

The rates of premium or discount are expressed by percentage of the par value. Thus when \$110 can be got for a share which was originally \$100, the stock is at a premium of 10% and is so expressed, or it is spoken of as being at 110. And when a similar share is sold for \$90 it is at a discount of 10%, or is said to be at 90. In like manner when a share, the par value of which is \$20, sells for \$21, it is at 5% premium, or 105, and when a similar share sells for \$16 it is at 20% discount, or 80.

A **Bond** is the obligation of a nation, province, city, town or company, to pay a sum of money at a specified time with interest at a stipulated rate, usually payable half-yearly. Bonds have the force of promissory notes against the government or corporation issuing them.

The bonds of governments and municipal corporations are often called debentures. Those of business corporations are frequently secured by mortgage of the whole or some portion of the company's property, and are thence called mortgage bonds. They are often a better and safer investment than the stock of the same company

Coupon Bonds are bonds with coupons attached for the regular payment of interest during the life of the bonds. As the payments of interest are made the coupons are detached and returned to the party who issued the bonds.

The income derived from bonds is called "interest," because it is received for the use of money loaned; while that derived from an investment in stock is known as "dividend," because it is a *division* of the profits of the company.

Stocks are usually sold "flat," that is, all future dividends accrue to the buyer, and are included in the quoted price of the stock; but the buyer of bonds bearing a fixed interest usually pays to the seller the accrued unpaid interest in addition to the price at the rate agreed upon.

In large centres where regular stock exchanges are established stocks are bought and sold either "cash," that is, deliverable on the day sold; "regular," that is, to be delivered and paid for the next day; "seller three," which gives the seller the option of delivery any time within three days, or "buyer three," which gives the buyer the option to demand delivery of the stock at any time within three days. Sometimes the option is for more than three days, in which case interest is paid by the buyer to the seller, and one day's notice is required to terminate the option.

Should a stock pay a dividend during the pendency of a contract the dividend belongs to the purchaser of the stock, unless otherwise previously agreed.

A **Margin** is a deposit made with a broker by a person who employs him to buy or sell stock for speculation to enable the broker "to carry" the stock, and protect himself against loss should the price of the stock decline. It is usually 10 % of the par value of the stock.

The commission for buying and selling stocks and bonds is reckoned by per centage of the par value, or market value, according to the custom of the place where the business is done. In New York and probably in other places where stock boards are established it is on the par value, and $\frac{1}{2}$ % is the customary rate, except for mining stocks, which have special rates. In Halifax the commission is from $\frac{1}{4}$ % to $\frac{1}{2}$ % on the market value.

STOCK QUOTATIONS.

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List of the principal local stocks as quoted by J. C. MACKINTOSH,
Banker and Broker, 166 Hollis Street, Halifax, N. S.:

Average prices of Stock, &c., on Thursday, 10th May, 1883.

PAR.	NAME OF STOCK.	LAST DIVIDEND.	SELLING ASK.	BUYING OFFER.
\$ 20 00	Halifax Banking Company.....	6 7/8	108	107 1/2
100 00	Bank of Nova Scotia	8	150 1/2	149
243 33	Bank of B. N. America.....	6	114	113
50 00	Union Bank of Halifax.....	6	115	113
20 00	Peoples Bank of Halifax ..	6	110	109 1/2
100 00	Merchants' Bank of Halifax.....	7	129	128 1/2
40 00	Commercial Bank, Windsor.....	8	135	133 1/2
40 00	Pictou Bank.....	6	110	106
200 00	Bank of Montreal	15	203	202 1/2
100 00	Merchants' Bank of Canada.....	7	126	125
50 00	Canadian Bank of Commerce.....	8	136 1/2	136
40 00	Ontario " ".....	6	115 1/2	115
100 00	Bank of New Brunswick.....	8	140	138
50 00	Molson's Bank.....	8	126	125
50 00	La Banque du Peuple.....	6	81	80
100 00	Bank of Toronto.....	8	140	138
INSURANCE COMPANIES.				
20 00	Halifax Fire Insurance Company.....	10	120	117 1/2
20 00	Acadia Fire Insurance Company (old).....	15	132	128
5 00	do. do. (new).....	15	131	127
25 00	Merchants' Marine Insurance Co. of Halifax...		75	50
DEBENTURES.				
£100	Sterling Provincial Debentures.....			
£500				
	1883.....		102	102 1/2
\$500 00	City Debentures.....			
1000 00				
2000 00	5 per cent.....		102	101
100 00	School do.			111
500 00	Dartmouth do.			104
	Montreal City Bonds.....			117
	Toronto do.			117
	St. John do.		112 1/2	111
	Charlottetown de.		108	104
MISCELLANEOUS.				
\$ 40 00	Halifax Gas Light Company.....		140	137 1/2
	Montreal Gas Light Company.....		173 1/2	173
100 00	Starr Manufacturing Company.....		105	100
100 00	Do. Preferential.....			109
25 00	Chebucto Marine Railway Company..		112	107
40 00	Montreal Telegraph Company.....		123 1/2	122 1/2
50 00	Dominion Telegraph Company.....		87 1/2	82 1/2
100 00	Nova Scotia Sugar Refinery.....		90	77 1/2
100 00	do. do. Cotton Company.....			

290
1450

240
3

EXERCISES.

Find the market prices of the following at the rates given :—

	NO. OF SHARES.	STOCK.	QUOTATIONS.
1	5	Halifax Banking Co.....	108
2	10	Peoples Bank of Halifax.....	110
3	15	Union Bank of Halifax.....	115
4	12	Merchants' Bank of Halifax.....	128½
5	25	Bank of Nova Scotia.....	150
6	100	Commercial Bank of Windsor.....	133½
7	17	Ontario Bank.....	115½
8	20	Bank of B. N. A.....	112½
9	8	Pictou Bank.....	107½
10	30	La Banque du Peuple.....	80
11	24	Bank of Toronto.....	139
12	18	Bank of New Brunswick.....	138½
13	100	Merchants' Bank of Canada.....	125½
14	31	Bank of Montreal.....	202½
15	20	Halifax Fire Insurance Co.....	117½
16	80	Halifax Gas Light Co.....	137½
17	40	Starr Manufacturing Co.....	100½
18	12	Chebucto Marine Railway Co.....	107½
19	15	Nova Scotia Sugar Refinery.....	82½
20	25	Nova Scotia Cotton Co.....	80½

21. What will be the cost of 7 shares Bank of N. S. stock @ 143½, and brokerage @ ¼% on the market value?
22. What will be the cost of 18 shares People's Bank stock @ 111½, and brokerage @ ¼% on market value?
23. What will the sale of 25 shares Merchants' Bank stock realize if sold @ 127½ by a broker charging ⅜% on the market value?
24. Sold through a broker 40 shares Bank of Montreal stock @ 201½, brokerage on market value @ ⅛%. How much was realized?
25. Bought 5 shares Bank of N. S. stock @ 151½, and sold the same @ 147½. How much did I lose?
26. Bought 10 shares Bank of Montreal stock @ 201½, and sold them at 195½. How much did I lose?
27. Bought 25 shares Union Bank stock @ 115½, and sold them @ 121½. How much did I gain?

*Original
omitted*

28. A broker purchased for Mr. A 50 shares Peoples Bank stock @ $110\frac{1}{2}$, and sold them at $117\frac{1}{2}$, charging $\frac{1}{4}\%$ commission on the market value, each transaction. What was A's gain?

29. Bought through a broker 15 shares Bank of B. N. A. stock @ $103\frac{1}{2}$, and sold the same @ $104\frac{1}{2}$, brokerage on market value @ $\frac{1}{4}\%$ each transaction. What did I gain or lose?

30. A bank with a capital of \$800000 declares a dividend of 3%. What is the amount of the dividend, and what does a stockholder receive who owns 25 shares of \$50 each?

31. An Insurance Company divides among its shareholders \$21000. What is the rate of the dividend, the capital stock being \$600000, and how much is paid to Mr. A. who owns 26 shares of \$40 each?

32. A manufacturing company declared a dividend of 4%, and it amounted to \$3000. What was the capital stock?

33. A gas company declared a half-yearly dividend of $3\frac{1}{2}\%$, and it amounted to \$10500. How many shares of \$40 each in the capital stock?

34. The profits of a half-year's business of a bank amounted to \$16485.25. What was the surplus after a dividend of $2\frac{1}{2}\%$ on a capital stock of \$500000 was provided for?

35. How many shares of the N. S. Sugar Refinery stock can be purchased for \$1764 @ 84?

36. How many shares of the Halifax Banking Co.'s stock can be purchased for \$1510.50 @ $108\frac{1}{2}$?

37. What is the par value of stock which cost \$7286.25, including brokerage on the market value @ $\frac{1}{2}\%$, when purchased @ 145?

38. What is the par value of stock which cost \$7275, including brokerage on the par value @ $\frac{1}{2}\%$, when purchased @ 145?

omitted 39. How many shares of the Chebucto Marine Railway Co.'s stock can be purchased for \$2346.01, including $\frac{1}{4}\%$ commission on the market value, @ $110\frac{1}{2}$?

40. How many shares of R. R. stock, (par value \$100), can be purchased for \$8112.50, including brokerage @ $\frac{1}{2}\%$ on the par value, @ 81?

41. What income will be derived from an investment of \$5125 in 5 % bonds @ 102½?
42. If the stock of a certain bank can be purchased @ 137½, and you make a investment at that rate through a broker who charges ½ % on the market value, what will be your income from an expenditure of \$9649.06, provided the bank pays an annual dividend of 8 %?
43. In the last question what would be the rate of interest on your investment?
44. Which would give the better rate of interest, an investment in 7 % bonds @ 150, or one in 6½ % bonds @ 125, and what is the difference?
45. What rate of interest would you obtain by investing in 6 % stocks @ 75?
46. When R. R. stock was @ 82½, A bought \$1000; how much did he pay, and how much did he gain by selling when it had risen to 86½?
47. What will \$850 stock cost @ 9½ % discount, ½ % on the par value being charged for brokerage?
48. On the data of the last exercise how much would be lost by selling out @ 10½ % discount, and paying ½ % brokerage?
49. What income should I get by investing \$1620 in 3 % stocks, @ 81?
50. What sum must be invested in 4 % stocks @ 84 to yield an income of \$280?
51. What rate of interest will a person receive by investing in 4½ % stocks @ 90?
52. A person transfers his capital from 3½ % stocks @ 77 to 4 % stocks @ 117½, what is the increase or decrease per cent. in his income.
53. A person transfers his capital from 4 % stocks @ 117½ to 3½ % stocks @ 77, what is the increase or decrease per cent. in his income?
54. A person sells out his 3 % stock @ 96, and invests the proceeds in 5 % stock at par; how much per cent. is his income increased?

55. What must be the market value of 6 % stock so that the investor shall make 5 % interest on his money!

56. What can I afford to pay for 8 % stock in order that my money may earn 6 %!

57. What must be the market value of $5\frac{1}{2}$ % stock in order that, after paying an income tax of 2 cents on the dollar, the investor may have 5 % interest on his money!

58. A gentleman invested \$7500 in $3\frac{1}{2}$ % stocks @ $94\frac{1}{2}$, and on their rising to 95 sold out and purchased Grand Trunk 4 % stock at par. How much was his annual income increased thereby!

59. How much a year better is it for a person to loan \$3800 @ 6 % than to purchase 5 % stock @ 95!

60. A person sold \$4200 R. R. stock paying 6 %, @ 115 , and invested $\frac{1}{2}$ of the proceeds in 3 % consols @ $80\frac{1}{2}$, and the balance in savings bank stock paying 9 %, @ $107\frac{1}{2}$. How much was his annual income increased or diminished!

61. A person having \$10000 consols sells \$5000 @ $94\frac{1}{2}$, and on their rising to $98\frac{1}{2}$ sells \$5000 more, and on their again falling buys back the whole @ 96. How much does he gain!

62. The sum of \$4004 was laid out in purchasing 3 % stocks @ $89\frac{1}{2}$, and a whole year's dividend having been received upon it, it was sold out, the whole increase of capital being \$302.40. At what rate was it sold!

63. On May 21st a broker purchased for me \$12000 6 % city bonds @ $104\frac{1}{2}$, the interest on these bonds is payable on the 1st Feb'y and August. What did the bonds cost me, the brokerage being $\frac{1}{2}$ % on the market value!

64. After receiving the interest on Aug. 1st on the bonds mentioned in the last exercise, the broker immediately sold it for me @ $103\frac{1}{2}$, charging $\frac{1}{2}$ % for selling. Did I gain or lose by the transaction, and how much money being worth 5 %!

65. On the 14th of March 1883, a broker purchased for me 100 shares Erie R. R. stock @ 71; 50 shares C. & R. I. R. R. stock @ $95\frac{1}{2}$; 200 shares N. Y. C. R. R. stock at $103\frac{1}{2}$, and a seventy-three bond for \$6000, (interest @ $7\frac{1}{2}$ % payable 1st June and December,) at $106\frac{1}{2}$. They were sold out on April 12th @ $68\frac{1}{2}$, $97\frac{1}{2}$, $103\frac{1}{2}$ and $106\frac{1}{2}$ respectively. What was the brokerage at $\frac{1}{2}$ %.

on the par value for buying and $\frac{1}{2}\%$ for selling, and what was my gain or loss by the transaction?

66. I have received from a correspondent \$4781.25 with instructions to invest the same in five-twenties @ 105 $\frac{1}{2}$ first deducting my commission @ $\frac{1}{4}\%$ on the par value. What is the brokerage, and what amount of five-twenties can I purchase?

67. On the 20th Feb'y 1883 a broker purchased for me 100 shares of the Bank of N. S. stock @ 151 $\frac{1}{2}$, 80 shares Peoples Bank stock @ 111 $\frac{1}{2}$, 120 shares Merchants' Marine Ins. Co.'s stock @ 77 $\frac{1}{2}$, and city debentures to the face value of \$6000, (interest at 5% payable half-yearly, March 1st and Sept. 1st,) @ 102. They were sold out at my order on May 17 @ 153, 109 $\frac{1}{2}$, 65 and 102 $\frac{1}{2}$ respectively. What was the brokerage @ $\frac{1}{4}\%$ on the market value each transaction, and what was my gain or loss on the transaction?

68. In a certain company only 40% of the subscribed capital is paid up when a cash dividend of 3 $\frac{1}{2}\%$ on the subscribed capital is declared. What rate per cent. does an original subscriber receive on his investment?

69. The stockholders of a certain bank have paid in but 25% of their subscriptions, and A is a subscriber to the extent of \$7500. A cash dividend of 4% on the paid-up capital is declared, and 10% of the paid-up capital is carried to the credit of the stockholders. How much is A's. cash dividend, what per cent. of subscribed capital is carried to credit of stockholders, and how much has A. still to pay on his stock?

70. An investor purchased railroad bonds @ 40% below par, and thus realized 10% on the price of the bonds when the annual interest on same was paid. He purchased also State securities bearing the same rate of interest 20% below par, and received annually on the latter \$2400. What did he pay for the State securities.

INSURANCE.

Insurance is a contract by which one party, called the Insurer or Underwriter, engages for a stipulated consideration, called the Premium, to indemnify another party called the Insured, against loss to which he or his family may be liable.

Insurance is effected on property against loss or damage by fire, water, &c., and on lives of persons, against sickness, accident and death. It receives different names, according to the kind of loss covered, as Marine, Fire, Life, Accident, &c.

Guarantee is another kind of insurance recently adopted, by which the insurer guarantees the honesty of employees in places of trust.

Insurance is usually carried on by companies or corporations, each company confining itself usually to one particular kind of insurance, although some of the larger companies combine two or more kinds.

Insurance companies may be classed as, 1. Stock ; 2. Mutual ; 3. Mixed.

A **Stock Insurance Company** is one in which the capital is owned by individuals called stockholders, who alone share the profits and assume to bear the losses that may be sustained.

A **Mutual Insurance Company** is one in which there are no stockholders, and the profits or losses of which are shared among those who are insured.

A **Mixed Insurance Company** is one conducted upon a combination of the stock and mutual plans.

The **Policy** is the written contract between the insurer or underwriter and the insured.

In marine insurance, in case of loss or damage, the insurer pays only such proportion of the loss as the amount of the insurance bears to the total value of the property ; but in ordinary fire insurance the total loss is made up if it does not exceed the amount of the insurance.

The **Premium** is the amount paid for insurance.

Premium rates are expressed as so much per cent. of the amount insured, or, where the rate is less than one per cent. it is often expressed as so many cents per hundred dollars; thus, "75 cents" means 75 cents on \$100, or $\frac{3}{4}$ of 1 per cent.

Life insurance premiums are determined by a scale which each company adopts for its own business, showing the premium on \$1000 at the various annual stages of human life. The scales are all formed, with more or less modification to suit the financial policy of the various companies, upon statistics from which the average expectation of life at any age is deduced.

EXERCISES.

1. Find the premium on an insurance of \$1280 @ $5\frac{1}{2}\%$.
2. A ship and cargo are insured for \$58,000 @ $2\frac{1}{4}\%$; what is the premium?
3. A ship is insured for \$35,000 @ $1\frac{1}{2}\%$, and her cargo for \$55,000 @ $2\frac{1}{2}\%$; what is the whole premium?
4. A house is insured for \$3500 @ 75 cents per \$100; what is the premium?
5. A house is insured for \$4000 @ 90 cents; what is the premium?
6. What is the total premium of the following insurances: \$5000 @ $1\frac{1}{2}\%$, \$7000 @ 45 cents, \$1500 @ 75 cents, \$2000 @ $4\frac{1}{2}\%$, \$3500 @ 45 cents, \$2000 @ 70 cents, \$4000 @ $1\frac{1}{4}\%$, \$2000 @ 60 cents, \$4500 @ 25 cents, \$3600 @ $1\frac{1}{4}\%$, and \$3000 @ $2\frac{3}{4}\%$?
7. A village store was insured for 6 years for \$1200; the rate for the first year was $3\frac{1}{4}\%$, with a reduction of $\frac{1}{4}$ each succeeding year. The stock was insured for \$1600 each of the six years @ $2\frac{1}{4}\%$. How much did the owner pay for insurance during the six years?
8. \$40 was paid for an insurance of \$2500; what was the rate of premium?
9. \$25.20 was paid for an insurance of \$3600; what was the rate?

10000

10. A building was insured for \$3000 @ $1\frac{1}{2}\%$ for 5 years, from June 1st, 1881; what was the value of the unearned premium on June 1st, 1883?
11. A shipment of goods, valued at \$5000, was insured for \$4000. If the goods were lost, how much of the loss would be paid by the insurance company?
12. A factory (worth \$3000) and its contents are insured for \$10,000 @ $2\frac{1}{2}\%$ as follows: \$2000 on building, \$3000 on machinery (worth \$5000), and \$5000 on stock (worth \$8000). The building is damaged by fire to the extent of \$1000, the machinery, \$4000, and the stock is a total loss. How much is the claim against the underwriters, and how much does the owner lose, including the premium?
13. If it cost \$22.50 to insure a house for \$5000, what was the rate?
14. If it cost \$56.87 $\frac{1}{2}$ for an insurance on merchandise @ $\frac{7}{8}\%$, what was the amount of the policy?
15. A building is insured for \$30,000, and is damaged by fire to the extent of \$12,000; what per cent. of its risk is paid by the insurance company?
16. Effected insurance on a cargo from Liverpool worth £1872 11s. 5d. at $1\frac{1}{2}\%$. What is the premium?
17. What will be the premium of insurance on a cargo from Havre, value 32450 francs, @ 1% , the franc being worth 19.3 cents?

PROFIT AND LOSS.

Profit and Loss treats of the actual gains and losses, and of the gain and loss per cent. arising from business transactions.

Gain or loss per cent. is always estimated on the cost price which therefore is always to be considered as the base. The actual gain or loss, which is the difference between the cost price and selling price, is the percentage reckoned on the base or cost. The selling price, when a gain is made, is the sum of the cost (base) and the gain (percentage) and is therefore the amount. When a loss is sustained the selling price is the net.

EXERCISES.

1. If 224 lbs. of tea be bought @ 60 cents per lb., and sold @ 95 cents per lb., how much is gained?
2. A grocer bought 24 bbls. flour @ \$5.80 per bbl., and sold 12 bbls. of it @ \$6.10, 9 bbls. @ \$6.20, and the remainder @ \$6.25; how much did he gain?
3. A man bought 216 yards flannel for \$86.40, and sold it @ $37\frac{1}{2}$ c. per yard; how much did he lose?
4. A dealer bought 78 bush. potatoes @ $62\frac{1}{2}$ cents, and sold them @ $87\frac{1}{2}$ cents; how much did he gain?
5. If I buy a horse for \$225, and sell it at a gain of 16 %; what will be my profit?
6. Bought a building lot for \$450, and sold it at a loss of 20 %; how much did I lose?
7. Cloth is bought @ \$3 per yard and sold @ 30 % advance; what is the selling price?
8. A farm cost me \$5200; what must I get for it to gain $22\frac{1}{2}$ %?
9. Flour cost 7 per bbl., and was sold @ a loss of 10 %; what was the selling price?

10. If hats cost \$21 per dozen, what is the retail price to gain $33\frac{1}{3}\%$?

11. If rubber coats cost at the manufacturer's \$96 per dozen, and if the cost of importation is 40 %, what must be the selling price to gain 20 %?

12. A merchant purchased goods to the amount of \$6280, and sold them for \$7222; what was the gain per cent.?

13. A quantity of goods was bought for \$318.50, and sold for \$299.39; what was the loss per cent.?

14. A grocer bought butter @ 24 cents and sold it @ 30 cents; what was his gain per cent.?

15. Bought 125 bbls. flour for \$600, and sold it @ \$5.52 per bbl; what was my gain per cent.?

16. A tobacconist bought a quantity of tobacco for \$75, which brought him only \$60; what per cent. did he lose?

17. A cattle dealer bought 20 cows at an average price of \$20 per head, and paid 50 cents for the freight of each per railroad; what per cent. did he gain by selling them @ \$25.62 $\frac{1}{2}$ per head?

18. A man paid \$1015 for merchandise, and sold it for \$875; what per cent. did he lose?

19. Find the rate per cent. of profit on goods bought for \$432 and sold for \$486.

20. If the Dr. side of your merchandise acct. amount to \$42,460, and the Cr. side to \$40,960.50, and the cost price of the goods remaining unsold be \$7600, what gain per cent. does the account show?

21. The Dr. side of a merchandise acct. is \$145,250, the Cr. side \$131,763.75, and the inventory \$16700; what is the gain per cent.?

22. If flaxseed is sold @ \$17.40 per bushel, and 13 % lost, what was the cost price?

\$17.40 is the net @ 13 %. To find the cost price (base) divide the given net by the net of 1, that is $\$17.40 \div .87 = \$20$, Ans.

23. How much was paid for a horse which was sold for \$108 @ 10 % loss?

24. A dealer sold 116 hogs for \$725, and thereby gain 25 %; what was the cost each to him, on an average?

25. If 13 sheep were sold for \$50.70 and 20 % gained, what was the first cost per head?

26. If $16\frac{2}{3}$ % be lost by the sale of linen @ \$1.25 per yard, what was the first cost?

27. A man sold goods @ $12\frac{1}{2}$ % profit and made \$76; what was the cost of the goods?

28. If a man buy a house, and lose $37\frac{1}{2}$ % by selling it for \$810 less than it cost him, how much did he get for it?

29. If a grocer sells wine @ 90 cents per bottle, and thereby gains 20 %, what per cent. would he gain by selling it @ \$1 per bottle?

30. If a hatter sells hats @ \$1.25 and loses 25 %, what would be the result of selling @ \$1.60 each?

31. If cloth is sold @ \$1.25 per yard and 15 % lost, what would be the result of selling @ \$.65 per yard?

32. If I sell cloth @ \$5 per yard and gain 25 %, what will be my rate of gain if I sell @ \$5.30 per yard?

33. If cloth be sold @ \$5 per yard at a loss of 25 %, what will be the result of selling @ \$6.40 per yard?

34. A milliner sold bonnets @ \$1.25 and lost 25 %; would she have gained or lost, and how much per cent. if she had sold @ \$1.40?

35. A grocer sold tea @ 45 cents per lb., and gained $12\frac{1}{2}$ %; what would he have gained per cent. if he had sold the tea @ 54 cents per lb.?

36. A farmer sold corn @ 65 cents per bushel, and gained 5 %; what per cent. would he have gained if he had sold the corn @ 70 cents per bushel?

37. If I buy a lot of wheat @ \$1.15 per bushel, what must I get per bushel for it so as to gain 15 %?

38. A man bought a horse for \$150 and a chaise for \$250, and sold the chaise for \$350 and the horse for \$100; what was his gain per cent.?

39. In one year the principal and interest of a certain note amounted to \$810 @ 8 %; what was the face of the note?

40. A carpenter built a house for \$990 which was 10 % less than it was worth; how much should he have received for it so as to have made 40 % profit?

41. A broker bought stocks @ \$96 per share, and sold them @ \$102 per share; what was his gain per cent.?

42. A merchant sold sugar @ $6\frac{1}{2}$ cents a lb., which was 10 % less than it cost him; what was the cost price?

43. A merchant sold broadcloth @ \$4.75 per yard, and gained $12\frac{1}{2}$ %; what would he have gained per cent. if he had sold it @ \$5.25 per yard?

44. A watch which cost me \$30, cash, I sold for \$35 on a credit of 8 months; what did I gain, allowing true discount @ 6 %?

45. Sold a horse at a gain of $33\frac{1}{3}$ % and with the proceeds purchased another horse which I sold for \$120 @ a loss of 20 %; what was the gain or loss?

46. If books are bought at 30 % discount from the list price, what is the gain % by selling at the list price?

47. What per cent. is gained by selling tin pans @ 21 cents, that cost \$2.56 per dozen less 20 and $12\frac{1}{2}$ %?

48. Bought a lot of broadcloth @ \$5 per yard; what must be my asking price so that I may fall 10 % and still make 10 % on the cost?

49. A gentleman sold two horses at \$240 each. On one he gained 60 per cent., and on the other he lost 60 per cent. Did he gain or lose by the operation, and how much?

50. What must I ask per yard for cloth that cost me \$3.52 per yard, so that I may fall 8 %, and still make 15 %, allowing 12 % of sales to be in bad debts?

51. A merchant's retail price for boots is \$4.75 per pair, by which he makes a profit of $33\frac{1}{3}$ %. He sells to a wholesale customer at a discount of 20 % from the retail price. What per cent. of his wholesales does he gain or lose?

52. If an article is bought at list price, 10 and 5 off, and sold at the list price 5 off, what is the gain per cent.?

53. A merchant purchased goods to the amount of \$7200, sold in 40 days to the amount of \$4900, had then on hand goods which cost \$3000. Find the total gain and the gain per cent., the average daily sales, and the average daily profits.

54. Sold merchandise at 30 % advance on cost, and then deducted 20 % from the face of the invoice. Required the net per cent. of gain.

55. Bought Bank of Montreal stock @ 180, and sold it @ 190; what was my gain per cent. ?

56. Bought Union Bank stock @ 118½, and sold it @ 115; what was my loss per cent. ?

BANKRUPTCY OR INSOLVENCY.

Bankruptcy or Insolvency is that condition of a business man's affairs in which his property is not sufficient to meet his liabilities.

A **Bankrupt** is one whose affairs are in a state of bankruptcy.

A **Debtor** is one who owes the bankrupt.

A **Creditor** is one to whom the bankrupt is indebted.

The **Assets** of a bankrupt are his entire property including the debts owing to him.

The **Liabilities** of a bankrupt are the debts which he owes.

An **Assignment** is a formal surrender of his property by a bankrupt for the benefit of a part or the whole of his creditors.

An **Assignee** is one to whom the property of a bankrupt is assigned.

A **Preferred Creditor** is one whom a bankrupt in his deed of assignment directs to be paid in full before any provision is made for the other creditors.

Canada is at present without a bankrupt law, so that preferred creditors, and frequent injustice are common in the settlement of insolvent estates which were not formerly permitted, and which a good bankrupt law should and would prevent. It is to be hoped that this state of affairs will not be permitted much longer to exist.

The rate per cent. of liabilities which an estate can pay is called the **Dividend**. To find the dividend, and thence the share

of each creditor—the available assets and liabilities being given—is the only problem with which we have to deal.

RULE.—Divide the net assets by the number denoting the liabilities; the quotient will show the rate per cent., or dividend. Then find the percentage of the several liabilities at this rate for the sum to be paid the several creditors.

EXERCISES.

1. A bankrupt owes A \$400, B, \$350, and C, \$600; his net assets amount to \$810. What is the dividend, and how much should each creditor receive?

2. A becomes bankrupt. He owes B \$800; C, \$500; D, \$1100, and E, \$600. The net assets are \$1110. How much can the estate pay on the dollar, and how much does each creditor receive?

3. A house becomes bankrupt with liabilities \$17,940, and assets \$8970. The expenses are 5 % of the assets. What is the rate of dividend, and what is the share of the chief creditor whose claim is \$1282?

✓ 4. A shipbuilder becomes bankrupt with liabilities \$303,000. The premises, building and stock are worth \$220,000, and he has in cash and notes \$12,842. The creditors allow him \$3000 for maintenance of his family, and the costs are $3\frac{1}{2}$ % of the remainder of the assets. What is the dividend, and how much does a creditor get whose claim is \$1360.60?

5. A Halifax house failed, owing in London \$22,000, in Glasgow \$18,000, in New York \$17,100, in Montreal \$16,000, in Toronto \$4400, and in Halifax \$4200. Their assets were real estate \$7200, cash \$4400, railway stock \$4200, merchandise \$9000, and good debts \$20,135. The expenses were 4 % of the assets. What was the dividend, and how much went to each city?

6. A merchant went into bankruptcy owing A \$1080, B, \$850, C, \$1720, D, \$1580, E, \$970. The assets were house and store which realized \$848, merchandise in stock which brought \$420, sundry debts collected \$220. The expenses were $12\frac{1}{2}$ %. What did the estate pay, and what was the share of each creditor?

EXCHANGE.

Exchange is the system by which merchants living in different countries, or in different parts of the same country, discharge their liabilities to each other without the transmission of money.

Suppose, for example : A, of Halifax, owes B, of Toronto, \$1000, and at the same time C, of Toronto owes D, of Halifax a like sum. Instead of A sending \$1000 to B, and C sending the same sum to D, A will purchase of D his order or draft on C, and send it to B, who will collect the money of C in Toronto. Thus D will get his money from A, his neighbor in Halifax, and B will get his from his neighbor, C, in Toronto. Now, of course, it does not always or often happen, that one debt can be set off against another in this way. The business of exchange is mostly carried on through the medium of the banks and exchange brokers who make it their business to buy and sell these drafts in sums to suit.

Thus, if A, of Halifax, who owes B, of Toronto, wishes to pay B, he goes to a bank or broker who will sell him a draft on some one in Toronto. This draft A forwards to B, who collects the money in Toronto; or B, of Toronto may draw a draft on A, of Halifax, and sell it to a bank or broker there, and receive his money, and A will pay the draft when presented to him in Halifax.

The price of these drafts, or, as it is usually called, the price of exchange, varies according to the state of trade between the two places, but it is never very far removed, where the currency of the two places is the same, from the face or par value.

To take the two places above mentioned, when Halifax buys much more largely from Toronto than Toronto from Halifax, exchange on Toronto will be high in Halifax, and exchange on Halifax will be low in Toronto. On the other hand when Toronto buys much more largely from Halifax than Halifax from Toronto the price of exchange will be exactly opposite.

When exchange can be bought dollar for dollar it is said to be at par. When a dollar of exchange can be bought for less than a dollar it is at a discount. When a dollar of exchange costs more than a dollar it is at a premium. The rate of discount or premium is expressed in percentage of one dollar.

DOMESTIC EXCHANGE.

Domestic Exchange is that between different parts of the same country.

Although a bill drawn in Canada and payable in the United States, or one drawn in the United States and payable in Canada is a foreign bill, yet as the monetary denominations of the two countries and their values are the same, bills between Canada and the United States are treated arithmetically as domestic or inland bills.

To find the cost or market value of a draft at a given rate of premium or discount.

RULE.—Add the percentage at the given rate of premium to, or subtract the percentage at the given rate of discount from, the face of the draft; the sum, or difference will be the market value.

EXERCISES.

Find the market values of the following drafts:—

- | | |
|---|---|
| 1. \$3000 @ $\frac{1}{8}$ per cent. prem. | 9. \$ 725.60 @ $1\frac{1}{2}$ per ct. prem. |
| 2. \$4600 @ $\frac{1}{4}$ " " | 10. \$5243.40 @ $\frac{1}{4}$ " discf. |
| 3. \$5600 @ $\frac{1}{8}$ " " | 11. \$2785.10 @ $\frac{1}{8}$ " " |
| 4. \$8425 @ $\frac{1}{8}$ " " | 12. \$1280 @ $\frac{3}{8}$ " " |
| 5. \$1875.50 @ $\frac{1}{4}$ " " | 13. \$4782.12 @ $3\frac{1}{4}$ " " |
| 6. \$7629.80 @ $\frac{3}{4}$ " " | 14. \$3900 @ $1\frac{1}{8}$ " " |
| 7. \$ 948.30 @ $\frac{5}{8}$ " " | 15. \$3794.75 @ $\frac{5}{8}$ " " |
| 8. \$5824.90 @ $\frac{7}{8}$ " " | 16. \$2500 @ $\frac{1}{4}$ " " |

17. What will be the cost of a bill on Montreal for \$2864.25 @ $\frac{1}{8}$ % premium?

18. A merchant in New York owing me \$3750 payable there, I drew on him for that amount, and sold the bill @ $1\frac{1}{8}$ % discount; what did I get for it?

To find the face of a bill which will cost, or sell for, a given sum, at a given rate of premium or discount.

RULE.—Divide the given market price by the cost or selling price of \$1 of the draft. The quotient will be the face of the bill required.

EXERCISES.

Find how large a bill can be had for

19. \$4000 @ 2 per ct. prem. 22. \$8706.18 @ $\frac{1}{4}$ per ct. disc.
 20. \$3638.10 @ $\frac{1}{2}$ " " 23. \$2735.22 @ $\frac{3}{8}$ " prem.
 21. \$1814.88 @ $\frac{1}{2}$ " disc. 24. \$ 859.99 @ $\frac{1}{4}$ " disc.

The same result to the nearest cent. may be obtained as follows:

EXAMPLE 1. How large a draft can be had for \$100,000 @ 5 % premium?

OPERATION.

$$\begin{array}{rcl}
 \$100000 & & \\
 - \quad 5000 & = 5 \% \text{ of the given sum.} & \\
 \hline
 \$95000 & & \\
 + \quad 250 & = 5 \% \text{ of } \$5000. & \\
 \hline
 \$95250 & & \\
 - \quad 12.50 & = 5 \% \text{ of } \$250. & \\
 \hline
 95237.50 & & \\
 + \quad .625 & = 5 \% \text{ of } \$12.50. & \\
 \hline
 95238.125 & & \\
 - \quad .031 & = 5 \% \text{ of } $.625 & \\
 \hline
 95238.094 & = \text{Face of draft required.} &
 \end{array}$$

EXAMPLE 2.—How large a draft can be had for. \$4285 @ $\frac{1}{2}$ % discount?

OPERATION.

$$\begin{array}{rcl}
 \$4285 & = \text{cost or market value given.} & \\
 + \quad 21.425 & = \frac{1}{2} \% \text{ of the given sum.} & \\
 + \quad .107 & = \frac{1}{2} \% \text{ of } \$21.425. & \\
 \hline
 \$4306.53 & = \text{Face of draft required.} &
 \end{array}$$

Of course where the given sum or rate or both are very large, the rate may be required to be applied several times. In any case the operation must be continued until the last percentage is insignificant in value.

25. What will a draft on Toronto for \$1978.60 cost @ $\frac{1}{4}$ % premium?

26. Bought goods of A, at Montreal to the amount of \$2796; for what sum should I accept his draft, exchange on Halifax in Montreal being $\frac{1}{4}$ % premium?

27. A commission merchant has \$963.78, net proceeds of a consignment sold for T. H. & Co., Chicago. What is the face of the draft he should remit them—Exchange on Chicago being $\frac{1}{4}$ % discount?

28. I have in my possession the net proceeds of a sale of cotton amounting to \$3765 which my correspondent desires me to remit him by a draft on New Orleans. Exchange on New Orleans is at a discount of $2\frac{1}{2}$ %, and I invest the whole in a draft at that rate. What is the face of the draft?

29. T. N. C. of Winnipeg owing J. B. P. of Halifax \$8432.80 payable in Halifax remits him a check on a Winnipeg bank, to cash, which J. B. P. is obliged to allow a discount of $\frac{1}{4}$ %. How much is the payment short, and what should have been the face of the draft?

FOREIGN EXCHANGE.

Foreign Exchange is exchange between different countries.

Foreign bills of exchange are usually drawn at sight (3 days) or at sixty (63) days' sight, and in the currency of the country in which they are payable.

Sight bills are sometimes spoken of as "short" exchange, and sixty days' bills as "long" exchange.

Foreign bills are usually drawn in sets of two or three, of the same tenor and date. The separate bills are sent by different mails, and when one has been paid or accepted the others are void. For sample of a set of sterling exchange see page 128.

A **Letter of Credit** is an instrument issued by a bank or banker, and addressed to another, or other banks or bankers requesting the payment to the holder on demand of such sums as he may require,—the total amount not to exceed a sum mentioned in the letter.

The **Rate of Exchange** between two countries is the market value in one of drafts on the other. It is regulated partly by the course of trade between the two countries, and partly by the cost of transporting gold.

The **Commercial Par of Exchange** is the market value in one country of the coins of another.

The **Intrinsic Par of Exchange** is the real value of the monetary unit of one country expressed in that of another. It is ascertained by a comparison of the fineness and weight of the coins of the two countries.

The **Old Par Value** of the pound sterling, and the base of the quotations of sterling exchange in Canada, is \$4.44 $\frac{1}{2}$. This value was fixed many years ago when the dollar represented a greater comparative value than at present. The rate of exchange is still expressed by percentage of this old par value. The commercial par of exchange between Canada and Great Britain is 9 $\frac{1}{2}$ % higher than the old par value, making the pound equal to \$4.86 $\frac{3}{4}$.

The rate of exchange with other countries is generally given by equivalents. Thus, quotations of French exchange is by giving the number of francs and centimes which make a dollar, or by giving the equivalent of a franc in cents.

In the United States the quotation of sterling exchange by percentage of the old par value has been discontinued, and there the quotations are now expressed by giving the value of £1 in dollars and cents.

Documentary Exchange is a bill drawn by a shipper on his consignee against merchandise shipped, accompanied by the bill of lading, and the insurance certificates covering the property against which the bill is drawn.

To find the value of £1 sterling at any rate of exchange.

RULE.—To the old par value (\$4.44 $\frac{1}{2}$) add the percentage at the given rate of premium.

Since 1 % of \$4.44 $\frac{1}{2}$ is 4 $\frac{1}{2}$ cents, when the value at any rate is known, for a higher rate add, and for a lower rate subtract, as follows : for 1 % 4 $\frac{1}{2}$ cents, for $\frac{1}{2}$ % 2 $\frac{1}{2}$ cents, for $\frac{1}{4}$ % 1 $\frac{1}{2}$ cents, for $\frac{1}{8}$ % $\frac{1}{2}$ of a cent, for $\frac{3}{4}$ % 3 $\frac{1}{2}$ cents. From this it is easy to construct the following

TABLE OF VALUES OF £1, STERLING.

At the old par rate,	\$4.44 $\frac{1}{2}$	At 9 $\frac{1}{2}$ per cent. prem.	\$4.85 $\frac{1}{2}$
" 1 per cent. prem.	4.48 $\frac{1}{2}$	" 9 $\frac{3}{4}$ " "	4.86 $\frac{1}{2}$
" 2 " "	4.53 $\frac{1}{2}$	" 9 $\frac{1}{2}$ " "	4.86$\frac{3}{4}$
" 3 " "	4.57 $\frac{1}{2}$	" 9 $\frac{5}{8}$ " "	4.87 $\frac{1}{2}$
" 4 " "	4.62 $\frac{1}{2}$	" 9 $\frac{3}{4}$ " "	4.87 $\frac{3}{4}$
" 5 " "	4.66 $\frac{1}{2}$	" 9 $\frac{7}{8}$ " "	4.88 $\frac{1}{2}$
" 6 " "	4.71 $\frac{1}{2}$	" 10 " "	4.88 $\frac{3}{4}$
" 7 " "	4.75 $\frac{1}{2}$	" 10 $\frac{1}{8}$ " "	4.89 $\frac{1}{2}$
" 8 " "	4.80	" 10 $\frac{1}{4}$ " "	4.90
" 8 $\frac{1}{8}$ " "	4.80 $\frac{1}{2}$	" 10 $\frac{1}{2}$ " "	4.91 $\frac{1}{2}$
" 8 $\frac{1}{4}$ " "	4.81 $\frac{1}{2}$	" 10 $\frac{3}{4}$ " "	4.92 $\frac{1}{2}$
" 8 $\frac{3}{8}$ " "	4.81 $\frac{3}{4}$	" 11 " "	4.93 $\frac{1}{2}$
" 8 $\frac{1}{2}$ " "	4.82 $\frac{1}{2}$	" 11 $\frac{1}{4}$ " "	4.94 $\frac{1}{2}$
" 8 $\frac{5}{8}$ " "	4.82 $\frac{3}{4}$	" 11 $\frac{1}{2}$ " "	4.95 $\frac{1}{2}$
" 8 $\frac{3}{4}$ " "	4.83 $\frac{1}{2}$	" 11 $\frac{3}{4}$ " "	4.96 $\frac{1}{2}$
" 8 $\frac{7}{8}$ " "	4.83 $\frac{3}{4}$	" 12 " "	4.97 $\frac{1}{2}$
" 9 " "	4.84 $\frac{1}{2}$	" 12 $\frac{1}{4}$ " "	4.98 $\frac{1}{2}$
" 9 $\frac{1}{8}$ " "	4.85	" 12 $\frac{1}{2}$ " "	5.00

To find the value of sterling money at \$4 to the pound.

RULE.—Multiply the pounds by 4, and add the equivalents of the shillings and pence as below.

TABLE OF VALUES OF SHILLINGS AND PENCE AT \$4 PER POUND.

5/	=	\$1.00
10/	=	2.00
15/	=	3.00
1/	=	.20
2/	=	.40
3/	=	.60
4/	=	.80
3 d.	=	.05
6 d.	=	.10
9 d.	=	.15
1 $\frac{1}{2}$ d.	=	.025
4 $\frac{1}{2}$ d.	=	.075
7 $\frac{1}{2}$ d.	=	.125
10 $\frac{1}{2}$ d.	=	.175

To reduce pence to cents.

RULE.—Multiply the pence by 10, and divide the product by 6.

EXERCISES.

Change the following sums to dollars and cents at \$4 per pound :

- | | |
|------------------|-------------------|
| 1. £24 10s. | 7. £128 14s. 7½d. |
| 2. £76 5s. | 8. £204 11s. 5d. |
| 3. £57 15s. | 9. £63 7s. 4½d. |
| 4. £83 10s. 6d. | 10. £5 12s. 1d. |
| 5. £347 16s. 3d. | 11. £17 19s. 2d. |
| 6. £95 3s. 9d. | 12. £49 8s. 8d. |

To find the value of sterling money at the old par rate (\$4.44⅔).

RULE.—Find the value at \$4 per pound and add ⅓ of that value.

EXERCISES.

Find the values of the following sums at the old par rate (\$4.44⅔).

- | | |
|--------------------|-------------------|
| 13. £73 6s. 6d. | 18. £417 16s. 4d. |
| 14. £18 2s. 10d. | 19. £1 4s. 9d. |
| 15. £72 17s. 7d. | 20. £0 9s. 6½d. |
| 16. £145 1s. 10½d. | 21. £34 19s. 1d. |
| 17. £91 11s. 2d. | 22. £63 12s. 6d. |

To find the value of sterling money at any rate of Exchange.

RULE.—Find the value at the old par rate (\$4.44⅔) and to it add the given percentage of premium.

EXAMPLE 1.—What is the value in Dominion currency, of £47 13s. 1½d. @ 109.

£47 13s. 1½d.

OPERATION.

4

\$190.625 = value @ \$4 per pound.

1 21.181 = " " 44⅔ cts. per pound.

\$211.806 = " " old par rate.

19.062 = 9% premium.

\$230.87 = value @ 109.

EXAMPLE 2.—Find the value of £239 9s. 8d. @ 110½.

£239 9s. 8d.

OPERATION.

$\begin{array}{r} \text{\$957.933} \\ 106.437 \\ \hline \text{\$1064.37} \end{array}$

= value @ \$4 per pound.
 = " " 44 cts. per pound.
 = " " old par rate.
 106.437 = 10 % prem.
 2.661 = $\frac{1}{4}$ % "
 $\begin{array}{r} \text{\$1173.47} \end{array}$ = value @ 110 $\frac{1}{4}$.

Observe, in Example 1, 9 % is $\frac{1}{10}$ of the value @ \$4 per pound. Observe also in Example 2, 10 % is the same as the value @ 44 $\frac{1}{2}$ cents. So that either operation can be performed with one addition.

EXERCISES.

Reduce to Dominion currency the following sums :—

- | | |
|--|---|
| 23. £19 12s. 4d. @ 109. | 30. £56 11s. 2 $\frac{1}{2}$ d. @ 109 $\frac{3}{4}$. |
| 24. £33 16s. 10d. " 108. | 31. £85 15s. 5 $\frac{1}{2}$ d. " 109 $\frac{1}{8}$. |
| 25. £2349 18s. 7d. " 108 $\frac{1}{4}$. | 32. £735 15s. 9d. " 109 $\frac{1}{8}$. |
| 26. £71 5s. 3d. " 108 $\frac{1}{4}$. | 33. £486 3s. 4d. " 110. |
| 27. £193 1s. 6d. " 108 $\frac{1}{4}$. | 34. £520 10s. 10d. " 110 $\frac{1}{4}$. |
| 28. £209 13s. 11d. " 109 $\frac{1}{8}$. | 35. £190 0s. 7d. " 110 $\frac{1}{8}$. |
| 29. £407 17s. 3 $\frac{1}{2}$ d. " 109 $\frac{3}{8}$. | 36. £308 19s. 9d. " 109 $\frac{1}{2}$. |

To find the value of sterling money at 109 $\frac{1}{2}$.

RULE.—Find the value at \$4 per pound, then add the aliquot parts for 80 cts. ($\frac{1}{5}$) and 6 $\frac{3}{4}$ cts. ($\frac{1}{12}$) of 80 cts.

EXAMPLE.—£175 17s. 6d. @ 109 $\frac{1}{2}$ (\$4.86 $\frac{3}{4}$.)

£175 17s. 6d.

OPERATION.

$\begin{array}{r} \text{\$703.50} \\ 140.70 \\ 11.725 \\ \hline \text{\$855.93} \end{array}$

= value @ \$4.
 = " " 80 cts.
 = " " 6 $\frac{3}{4}$ cts.
 = " " \$4.86 $\frac{3}{4}$ (109 $\frac{1}{2}$).

The value @ 6 $\frac{3}{4}$ cts. is equal to 1 $\frac{1}{2}$ %. Therefore the value at any other rate can be got from the above by adding or subtracting the aliquot parts of this line for the difference between the given rate and 9 $\frac{1}{2}$ %.

To reduce Dominion currency to sterling.

RULE.—Divide the given amount of Dominion currency by the value of £1 at the given rate.

EXAMPLE.—What is the face of a sterling bill which can be bought for \$61.44 @ 109½?

OPERATION.

$4.86\frac{2}{3})61.44(\text{£}12\ 12s.\ 6d.\ \text{Ans.}$

37. What amount of sterling money @ $9\frac{1}{2}\%$ prem. can be bought for \$1000?

38. What is the value of £50 sterling @ 110?

39. At 12 % premium what will a draft on Liverpool for £1800 cost?

40. A merchant sold a bill of exchange on London for £7000 @ 11 % premium. What did he receive for it more than its commercial par value?

41. What must I pay for a bill on London for £1266 15s. @ 109½?

42. How much sterling exchange @ 108½ can I buy for \$822?

43. Bought £168 15s. sterling exchange for \$817.50. What was the rate?

44. If a bill of exchange for £427 12s. cost \$2073.86, what is the rate?

45. What must be paid for a draft on Paris for 15750 francs, exchange being 5.19 (5 francs, 19 centimes per dollar)?

46. What will a French bill for 31895.50 francs cost when exchange is quoted @ 18 $\frac{1}{10}$ (18 $\frac{1}{10}$ cents per franc)?

47. When \$1566.20 is paid for a draft for 8200 francs, what is the rate of exchange by the method of quotation used in Ex. No. 46?

48. A draft on Havre for 7419.50 francs was bought for \$1420; what was the rate of exchange, by the method of quotation employed in Ex. No. 45?

49. Paid for a draft on Paris and brokerage @ $\frac{1}{2}\%$ \$3460.32; what was the face of the draft, exchange being 5.19½?

50. Bought through a broker exchange on Geneva for 8000 francs; what did it cost me, exchange 5.20 $\frac{1}{2}$ and brokerage $\frac{1}{2}$ %?
51. A merchant, having a bill of exchange for 18000 francs to sell, sent a clerk to two bankers to sell to the best advantage. The first applied to offered to buy the bill @ 5.25, the second @ 5.25 $\frac{1}{2}$. The clerk took the latter offer. How much did the merchant lose by his clerk's ignorance?
52. A merchant in Halifax owes 12000 francs in Paris; how much will a sterling bill to settle the account cost him, exchange on London in Paris being 25.20 francs per pound, and sterling bills in Halifax 109 $\frac{1}{2}$?
53. A merchant in Halifax wishes to purchase for remittance to Hamburg a bill of exchange for £358 14s. 9d. Sterling exchange in Halifax is @ 109 $\frac{1}{2}$, in New York 1.85 $\frac{1}{2}$. His correspondent in New York will reinvest and remit for him at $\frac{1}{2}$ % commission, and drafts on New York are at $\frac{1}{2}$ % premium. How much will he lose or gain by remitting via New York?
54. A broker sold for a merchant on commission a bill of exchange for £2000. He was to receive $\frac{1}{10}$ % on the commercial par value of the bill, and 5 % on whatever he obtained more than the commercial par value. What did his commission amount to?
55. I owe A. N. McDonald & Co., of Liverpool, \$7218, net proceeds of sales of merchandise effected for them, which I am to remit them in a bill of exchange on London for such amount as will close the transaction, less $\frac{1}{2}$ per cent. for my commission for investing. Bills on London are at 109 $\frac{1}{2}$. Required the amount of the bill, in sterling money, to be remitted.
56. When exchange between Montreal and Hamburg is at 24 cents per mark, and between Hamburg and St. Petersburg is 2 $\frac{1}{2}$ marks per rouble, how much should be paid in St. Petersburg for a draft on Montreal for \$650?
57. A merchant shipped 2560 barrels of flour to his agent in Liverpool, who sold it at £1 8s. 6d. per barrel, and charged 2 per cent. commission; what was the net amount of the $\frac{1}{2}$ in decimal money, allowing exchange to be at a premium of 8 per cent.?

58.

PARIS, Jan'y, 4th, 1883.

Messrs. S. E. Whiston & Co., Halifax, N. S.

Bought of Paris Branch,
Grimault & Co.

5 doz. asst'd Perfume, 20.80 fr.....	f.104.00
28 " gross asst'd Soaps, 16.10.....	450.80
	<u>554.80</u>
15 % discount.....	83.22
	<u>471.58</u>
Less Freight to Liverpool....	34.08
	<u>f.437.50</u>

What must be the face of a sterling draft to pay the above bill reckoning 25f. per pound sterling, and what will it cost when sterling exchange in Halifax is 109 $\frac{1}{2}$.

59. A merchant in St. John having to remit £434 15s. to Liverpool, wishes to know which is the most profitable, to buy a set of exchange on Liverpool at 10 $\frac{1}{2}$ per cent. premium, or send it by way of France; exchange on the latter place being 19 $\frac{3}{4}$ cents per franc, and exchange on Liverpool can be bought in France at the rate of 24 $\frac{1}{2}$ francs per pound sterling, and he has to pay his correspondent in Rouen $\frac{3}{4}$ of 1 per cent. for purchasing the bill on Liverpool.

60. Hughes Bros. & Co. purchase of E. Chaffey & Co., a sterling bill at 60 days on Gladstone & Hart, of London, for £3956 10s. They remit this bill to James Alder, in London, where it is accepted by Gladstone & Hart, and falls due on the 20th November, at which time it is protested causing an expense of £2 19s. Gladstone & Hart having failed, E. Chaffey & Co.'s agent in London pays James Alder on the 20th November, £2000 on account. How much must E. Chaffey & Co. pay to Hughes, Bros. & Co., on the 24th December, to cover the amount still due in London, allowing interest at the rate of 10 per cent. from November 20th, to the maturity of a 60 days' bill at date of 24th December, and $\frac{1}{4}$ of 1 per cent. commission for their trouble in negotiating a new bill?

TAXES AND DUTIES.

A **Tax** is a money payment, assessed upon the subjects of a State, or the members of any community for the support of the government, and sometimes for the protection of home industry.

A **Direct Tax** is an assessment made on all citizens in proportion to the value of their property, or a levy upon the persons of individuals without regard to property. In the latter case it is called a **Poll Tax**.

Indirect Taxes are called duties, and are either *customs* or *excise*.

Customs Duties are taxes levied upon imported merchandise.

Excise Duties are taxes levied upon merchandise manufactured in the country.

All duties are paid directly by the importers or manufacturers of the goods taxed, but indirectly by those who buy and consume them.

Duties are either *specific* or *ad valorem*.

A **Specific Duty** is a tax assessed at a certain sum per ton, pound, yard, gallon, or other weight, or measure, without regard to the value of the goods.

An **Ad Valorem Duty** is a tax assessed at a certain rate per cent. on the actual or fair market value of the goods in the country from which they were imported.

The dutiable value of imported merchandise is generally ascertained from the invoice given by the seller or shipper at the place of shipment. But dutiable goods are subject to appraisement, so that the invoice price is not always taken as the dutiable value.

Before duties are calculated certain allowances are deducted which vary according to the kind of goods upon which the duties are levied. Among these are the following:

Geo. H. Cox,
SHELBOURN, N. S.

Breakage,—an allowance on liquids contained in bottles, or other breakable vessels.

Leakage,—an allowance on liquids in barrels or casks.

Tare,—an allowance for the weight of the box, barrel or other case in which the goods are enclosed.

Net Weight, is the weight after all allowances are deducted.

Gross Weight, is the weight before any allowances are deducted.

On some articles the duty is both specific and ad valorem. Thus, the duty on tobacco is 25 cents per lb., and $12\frac{1}{2}\%$.

A **Bonded Warehouse** is a place for the storage of merchandise on which the duties have not been paid.

EXERCISES.

1. Find the duty on 5120 lbs. sugar, the tare being 14 %, and the duty 1 cent per lb., and 30 %, dutiable value 6 cents per lb.

2. What is the duty on a quantity of silks, the dutiable value being 50000 francs, and the duty 30 %?

3. What is the duty on an importation of china, the invoice price of which is £258 18s. 1d. @ 25 %?

4. What is the duty on an importation of tobacco,—net weight 857 lbs., value 18 cents per lb., duty 25 cents per lb., and $12\frac{1}{2}\%$?

5. What is the duty @ 10 cents per lb. and 25 % on an importation of woolen clothing, net weight 1265 lbs., and dutiable value £442 8s. 7d.?

6. A merchant imported 10 pieces Scotch tweed, viz., 42 yds. @ 5/, 44 yds. @ 4/10, 51 yds. @ 6/6, 42 yds. @ 3/9, 47 yds. @ 3/10 $\frac{1}{2}$, 45 yds. @ 4/, 40 yds. @ 5/3, 128 yds. @ 7/2, the whole weighing 1427 lbs. What was the duty @ $7\frac{1}{2}$ cents per lb., and 20 %?

7. Imported from London 10 doz. ready made cotton shirts @ 48/ per doz., 15 doz. cotton undershirts @ 17/6 per doz., and 10 doz. pairs cotton drawers @ 15/3 per doz. What was the duty @ 30 %?

8. What is the duty on 425 gross steel pens costing 30 cents per gross, less 10 %; duty 20 %?

Business College

EXERCISES.

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9. What is the total amount of duty on the following, viz:—

- 1 case felt hats, value £14 4s. 9d. @ 25 %.
- 1 " prints, " £30 5s. 9d. " 20 %.
- 1 " mantles, " £55 19s. 7d. weight
- 166 lbs. @ 10 cts. per lb. and 25 %.
- 1 case girdles value £37 9s. 7d. @ 30 %.
- 1 " trimmings " £9 13s. 5d. @ 20 %.
- 1 " feathers " £80 18s. 6d. @ 25 %.
- 1 " flowers " £60 15s. 7d. @ 25 %.
- 1 " laces " £132 8s. 5d. @ 20 %.

10. McLeod & Co. import from Cadiz 10 casks port wine containing 48 gallons each @ $2\frac{1}{2}$ pesetas per gallon; 20 casks sherry wine 48 gallons each @ 2 pesetas per gallon, and 80 baskets champagne, 1 dozen bottles each at 10 pesetas per basket. The allowance for leakage was one gallon per cask, and for breakage 5 %. The duty on the port and sherry was 52 cents per gallon, and 30 %, and on the champagne \$3 per dozen and 30 %. What did it amount to, the peseta being $19\frac{3}{5}$ cents?

11. What is the duty at one cent per square yard, and 15 % on an importation of unbleached cotton cloth all one yard wide, viz: 132 yds. @ 8c., 257 yds. @ $7\frac{1}{2}$ c., 47 yds. @ 9c., 334 yds. @ $8\frac{1}{2}$ c., 95 yds. @ $9\frac{1}{2}$ c., 226 yds. @ 10c., and what rate per cent. is the whole duty equal to?

12. What is the duty at 2c. per square yard and 15 % on a lot of cotton cloth as follows: 475 yds., $\frac{3}{4}$ of a yd. wide, @ 11 c., 372 yds., $1\frac{1}{4}$ yds. wide, @ 13c., 136 yds., 30 inches wide, @ 12c., and 567 yds., 33 inches wide @ $22\frac{1}{2}$ c? Find also what rate per cent. the duty on each lot is of its dutiable value, and what is the average rate on the whole?

13. J. Johnson & Co. import from Liverpool 10 pieces carpet, 40 yds. each, $\frac{3}{4}$ of a yd. wide, and invoiced @ 5/ per yd., on which the duty is 10c. per square yd. and 20 %: 200 yds. hair cloth @ 4/, duty 20 %; 100 pairs woolen blankets @ 7/6 per pair, weight 472 lbs., duty $7\frac{1}{2}$ c. per lb. and 20 %, and shoe lasting to the amount of £60, duty 25 %. Required the whole duty, and what rate per cent. it is of the invoice price.

14. Find the rate per cent. of advance on the net amount of the following invoice that will cover expenses, the total cost in

store, and the rate per cent., the total cost is of the gross amount of the invoice; also what must be the selling price per gross of each sort to make a profit of 20 %.

TERMS CASH.

NEW YORK,

JULY 5TH, 1883.

S. E. WHISTON, Esq., *Halifax, N. S.*

Bought of J. C. P. FRAZEE & Co.

19 Blackwell St.

168 gross 8 oz. bottles	\$2.88	\$ 483.84
91 " 16 oz. "	5.11	465.01
40 " 18 oz. "	8.27	330.80
	(Gross)	<u>\$1279.65</u>
	Trade discount 66 $\frac{2}{3}$ %	853.10
		<u>\$ 426.55</u>
	10 %	42.65
		<u>\$ 383.90</u>
	5 %	19.20
	Net	<u>\$ 364.70</u>
Cartage to Pier		5.25
Freight to Boston		18.96
		<u>\$ 388.91</u>

Duty 30 %*, truckage to store \$3.75, freight Boston to Halifax \$9.30.

15. What figures should fill the blanks in the following invoice and entry?

* The customs authorities add 2 % to the net amount of cash American invoices when making up for duties.

EXERCISES.

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Mark
T x A
H

BIRMINGHAM, May 30th, 1883.

MESS. THEAKSTON & ANGWIN,

Bought of

B. & S. H. THOMPSON.

Per "Nova Scotian" SS.

1 cask Shovels 40			
6 doz "Elwell's" Iron Shovels, ea 1 & 2,	cwt. 3, 2, 0, @ 36/6	• • •	
	45%	• • •	3 10 3
Cask 6/6	Delivered		6 6
			3 16 9
Cask 41.			
2 doz. fine ward Stock Locks, ea 18/ 26/	8 10 in, 62%	• • •	
		• • •	1 13 0
1 " best " " 18/ 26/	ea 8 10 in, 52 1/2%	• • •	
		• • •	1 0 11
2 " Brass Night Cocks, No. 0, 1/2 in, 18/		• • •	
1 " " lock " " 1/2 in, 21/		• • •	
	50%	• • •	1 8 6
12 " Japd. Padlocks, 2 1/2 in ea, 337, 339	2/5 2/10		
	8/ 3/3	• • •	
6 " " " 2 1/2 in ea, 339, 340		• • •	
8 " " " 2 1/2 in ea, 345	5/	• • •	
2 " bright Chest Locks, 47654, 4 in, 9/		• • •	
6 " " " 47639, ea 3 3 1/2 in	2/4 2/4	• • •	
	3/ 3/	• • •	
6 " " " 47645, ea 3 3 1/2 in		• • •	
Cask etc, 9/8, lined with waterproof paper }		• • •	
Carriage to Liverpool cwt 3, 1, 20 4/ }		• • •	
			15 18 7
Brought forward amount of			
1 cask Shovels, 40		3 16 9	
1 " Hardware, 41		15 18 7	
		19 15 4	
Commission 7 1/2 % on		• • •	
Shipping Charges and Bills of Lading		0 8 9	
Insurance to Halifax against all risks on £25		• • •	
@ 12/6, Policy 9d.			
E. & O. E.		£21 15	
B. & S. H. Thompson.			



25

2



EQUATION OF PAYMENTS.

FOR DUTY.

Port of Halifax, 18th June, 1883.

Report No.....

Entry No.....

Imported by Theakston & Angwin per SS Nova Scotian, Richardson master, from Liverpool.

Marks and Numbers.	No. of Package.	Description of Goods.	Value.† Dollars. Cts.	Quantity	Rate of Duty	Amount of Duty. Doll's. Cts.
T x A H 40 41	1	Cask Shovels £3 10s. 4d	** **			** **
	1	Cask.			30%	
		Locks £13 16s. 5d.	** **		30%	** **
		Mfra. Brass £1 8s. 6d.	* **		30%	* **
						<u>£27 30</u>
		Theakston & Angwin.				

† The value is not to be taken as the value of the goods.

† The value is extended to the nearest dollar. When the cents are 50 or more the dollars are increased by 1.

EQUATION OF PAYMENTS.

Equation of Payments is the process of finding at what date several debts which are due at different times may all be paid at once so that neither party may lose by interest.

Where several debts are due on different dates if the whole of them be paid in one sum the day on which the first of them is due, it is evident that all the others will be paid before they are due, and that the payer will *lose* the use or interest of these sums for the time between the day on which he paid them and the dates on which they are severally due. On the contrary if he do not pay any till the last becomes due, and then pay the whole at once, he will *gain* the use or interest of those sums

that were due before that time from the dates on which they were severally due to the date of payment, and the payee will lose correspondingly. It is also evident that a date may be found somewhere between the date for the first payment and that for the last on which if the whole be paid the payer will gain as much interest on what he retains after it is due as he will lose on what he pays before it is due. This date is the **Average Date** which is sought in Equation of Payments.

Assuming any starting point, the average date will be as far removed from this point as the time during which the sum of the payments would gain as much interest as the several payments would from the same starting point to the dates on which they are payable. Thus suppose A owes B \$1200 which he is to pay by instalments as follows: \$300 in 4 mos., \$500 in 6 mos. and \$400 in 10½ mos. Assuming as the starting point the date from which the 4, 6 and 10½ mos. count, A is to have the use of \$300 for 4 mos., interest \$6, \$500 for 6 mos., interest \$15, and \$400 for 10½ mos., interest \$21, in all \$42. Now if, instead, he be allowed the use of the whole \$1200 until the interest of it is \$42, and then pay the whole sum at once, it will be the same to him so far as interest is concerned; and if the same to him it will be the same to his creditor. The interest of \$1200 will amount to \$42 in 7 months, therefore 7 months is the equated time.

The following method founded on the above principle is that usually adopted:—

$$\begin{array}{rcl}
 \$300 \times 4 & = & 1200 \\
 500 \times 6 & = & 3000 \\
 400 \times 10\frac{1}{2} & = & 4200 \\
 \$1200 &) & \begin{array}{l} 8400 \text{ (7 months,} \\ 8400 \text{ equated time.} \end{array}
 \end{array}$$

The interest of \$300 for 4 mos. is the same as the interest of \$1 for 1200 months; the interest of \$500 for 6 months is the same as the interest of \$1 for 3000 months; and the interest of \$400 for 10½ months is the same as the interest of \$1 for 4200 months. The sum of all these is 8400 months; therefore the interest of the whole is the same as the interest of \$1 for 8400 months.

RULE 1.—Multiply each payment by its time, and divide the sum of the products by the sum of the payments.

Interest of \$300 for 4 months = \$12.00 @ 12 per cent.
 " 500 for 6 months = 30.00 @ " "
 " 400 for 10½ months = 42.00 @ " "
 " \$1200 for 1 month = \$12)84.00 (7 months.

NOTE.—12 per cent. is a very convenient rate, because the interest is so easily found, being 1 per cent. a month, and consequently the hundredth part of the principal for 1 month. The interest is therefore found by simply multiplying the principal by the number of months, and pointing off two places of decimals.

EXERCISES.

OPERATION.

When the division is not exact, continue it to two places of decimals, and reduce to days.

2. If a person owes \$1200, to be paid in four instalments, \$100 in 3 months; \$200 in 10 months; 300 in 15 months, and \$600 in 18 months, in what time should he pay the whole sum at once?

In this and similar questions, the work may be somewhat shortened by counting no time for the first payment, and deducting its time from that of each of the others. Thus:

$$\$100 \times 0 = 0$$

$$200 \times 7 = 1400$$

$$300 \times 12 = 3600$$

$$600 \times 15 = 9000$$

$\$1200 \quad) \quad 14000 \quad (\quad 11\frac{2}{3}$, to which add 3 months, and we have for the equated time $14\frac{2}{3}$ months.

3. J. Smith owes R. Evans \$1300, of which \$700 are to be paid at the end of 3 months, \$100 at the end of 4 months, and the balance at the end of 8 months. Required the equated time for the payment of the whole.

4. T. C. Musgrove owes H. W. Field \$900, of which \$300 are due in four months, \$400 in 6 months, and \$200 in 9 months; what is the equated time for the payment of the whole amount?

5. A. & W. McKinlay have in their possession five notes drawn by G. W. Armstrong, all dated 1st January, 1883; the first is drawn at 4 months, for \$45; the second at 8 months, for \$120; the third at 10 months for \$75; the fourth at 11 months, for \$60; and the fifth at 15 months, for \$90: for what length of time must a single note be drawn, dated 1st May, 1883, so that it may fall due at the properly equated time?

6. A gentleman left his son \$1500, to be paid as follows: $\frac{1}{3}$ in 3 months, $\frac{1}{3}$ in 4 months, $\frac{1}{3}$ in 6 months, and the remainder in 8 months; in what time ought the whole to be paid at once?

7. A merchant bought goods amounting to \$6000. He agrees to pay \$500 down, \$600 in 6 months, \$1500 in 9 months, and the remainder in 10 months. In what time ought he to pay the whole in one payment?

8. A grocer sold 484 bbls. rosin as follows: Feb'y. 6, 35 bbls. @ \$3.12 $\frac{1}{2}$, on 4 months time; March 12, 38 bbls. @ \$3.00, on 4 months time; April 12, 411 bbls. @ \$2.62 $\frac{1}{2}$, on 4 months time.

EQUATION OF PAYMENTS.

What is the equated time for the payment of the whole?

OPERATION.

	m. d.	
Feby. 6.....	109.375	$\times 0, 6 = 22$
March 12.....	114.	$\times 1, 12 = 114$
		44
April 12.....	1078.875	$\times 2, 12 = 2158$
		432
	1302.25	) 2770
		(2.13
		30
		3.90

2 months, 4 days, not reckoning the credit of 4 months on which the whole was bought. Add 4 months to this time, and the result is 6 months, 4 days to be counted forward from the beginning of February, making August 4th the date on which the whole should be paid.

In the above example we have taken the beginning of February as a convenient point from which to reckon the time on each item. From that point the time on the first item (omitting the 4 months which is common to all the items) is 6 days, or the second 1 month, 12 days, and on the third 2 months, 12 days.

When the time is expressed in months we have simply to multiply by the months. When there are days multiply $\frac{1}{12}$ of the principal by $\frac{1}{3}$ of the number of days, for the reason that $\frac{1}{12}$ of the principal is the product by $\frac{1}{12}$ of a month, or 3 days, and as 6 days are twice 3 days the product to be carried out is twice $\frac{1}{12}$ of the principal. Now $\frac{1}{12}$ of the principal is obtained by simply cutting off the right hand figure, the remainder to be increased by one if the figure cut off is 5 or more. Thus, in the above example, we have carried out twice 11, in the first item, for 6 days, 4 times 11, in the second item, for 12 days, and 4 times 108, in the third item, for 12 days.

When the number of days does not contain 3 an integral number of times the nearest smaller number that does may be taken first, and then the odd days over, which must be either $\frac{1}{3}$ or $\frac{2}{3}$ of 3 days. Work 5 days as $\frac{1}{3}$ of a month, 6 days as $\frac{1}{2}$, 10 days as $\frac{1}{3}$, and 15 as $\frac{1}{2}$, when more convenient.

In performing the multiplications and division the cents need not be noticed, except to increase the dollars by 1 when the cents are 50 or more.

9. Purchased goods of J. R. Worthington & Co. at different times, and on various terms of credit, as by the following statement:—

March 1, 1882,	a bill of	\$675.25	on 3 months.
July 4,	"	"	876.18 " 4 "
Sept. 25,	"	"	821.75 " 2 "
Oct. 1,	"	"	961.25 " 8 "
Jan. 2, 1883,	"	"	144.50 " 3 "
Feb'y. 10,	"	"	811.30 " 6 "
March 12,	"	"	567.70 " 5 "
April 15,	"	"	369.80 " 4 "

What is the equated time for the payment of the whole?

OPERATION.

	m.	d.	
March 1, 1882—3—	675.25	$\times 3, 1=$	2025 for 3 mos.
		22 "	1 day.
July 4, " —4—	876.18	$\times 8, 4=$	3008 " 8 mos.
		38 "	3 days.
		13 "	1 "
Sept. 25, " —2—	821.75	$\times 8, 25=$	6576 " 8 mos.
		656 "	24 days.
		27 "	1 "
Oct. 1, " —8—	961.25	$\times 15, 1=$	14415 " 15 mos.
		32 "	1 day.
Jan'y. 2, 1883—3—	144.50	$\times 13, 2=$	1885 " 13 mos.
		10 "	2 days.
Feb'y. 10, " —6—	811.30	$\times 17, 10=$	13787 " 17 mos.
		270 "	10 days.
March 12, " —5—	567.70	$\times 17, 12=$	9656 " 17 mos.
		228 "	12 days.
April 15, " —4—	369.80	$\times 17, 15=$	6290 " 17 mos.
		185 "	15 days.
	4727.73)	59123	(12—15,

That is, a little more than 12 months, 15 days from the beginning of March, 1882, which will be March 16th, 1883. Ans.

3 months' credit on the first bill, and 1 day in March give the time on the first bill; 4 months from March to July and 4 months' credit with 4 days in July give the time on the second bill; 6 months from March to September, and 2 months' credit with 25 days in September give the time on the third bill, &c.

To carry out the products,—1st, multiply the first bill by the months;—for the one day, take $\frac{1}{3}$ of 68. 2nd, multiply the second bill by the months, throw off the 6 and take the remaining figures of the principal, plus 1, for 3 days,—take $\frac{1}{3}$ of that for 1 day. 3rd, multiply 822 by 8, for 8 months,—multiply 82 by 8, for 24 days,—take $\frac{1}{3}$ of 82 for 1 day, &c.

10. Bought of A. & W. Smith, 1650 barrels of flour, at different times and on various terms of credit, as by the following statement:—

May 6th,	150 barrels @ \$4.50,	on 3 months' credit.
May 20th,	400 " " 4.75,	on 4 " "
July 10th,	500 " " 5.00,	on 5 " "
August 4th,	600 " " 4.25,	on 4 " "

What is the equated time for the payment of the whole?

11. J. B. Smith & Co. bought of A. Hamilton & Son 576 barrels of rosin, as follows:—

May 3,	62 bbls. @ \$2.50,	on 6 months.
May 10,	100 " " 2.50,	on 6 months.
May 18,	10 " " 2.50,	as cash.
May 26,	50 " " 2.75,	on 30 days.
May 26,	345 " " 2.50,	on 6 months.
May 26,	9 " " 2.00,	on 6 months.

What is the equated time for the payment of the whole?

12. T. R. Jones & Co. sold goods on 3 months' credit, as follows:—

May 9,	a bill of \$435.60.
" 30,	" " 75.30.
July 17,	" " 183.75.
Aug. 28,	" " 239.18.
Sep. 21,	" " 82.10.
Oct. 23,	" " 39.85.
Nov. 30,	" " 390.67.

When, in equity, ought they to have received the whole in one sum, and, allowing money worth 6 per cent., what sum ought they to have received at the date of the last sale?

13. Bought of T. & E. Kenny, on 6 months' credit, goods as follows:—

1882.

January	3,	to the amount of \$250.00.
February	6,	" " " 317.40.
March	9,	" " " 171.70.
April	12,	" " " 88.12.
May	15,	" " " 623.50.
June	18,	" " " 49.04.
July	21,	" " " 73.90.
August	24,	" " " 218.75.
Sept'ber.	27,	" " " 8.15.
October	30,	" " " 55.84.
Nov'ber.	29,	" " " 398.00.
Dec'ber.	11,	" " " 191.25.

What is the equated time of settlement, and allowing interest at 7 per cent., if payment be delayed till February 1st, 1883, how much will then be due?

AVERAGING ACCOUNTS.

When one merchant trades with another, exchanging merchandise, or giving and receiving cash, the memorandum of the transactions is called an *Account Current*. The fixing on a time when the account may be settled by simply paying the balance without interest against either party, is called *Averaging the Account*.

EXAMPLE 1.—A merchant sold goods amounting to \$4000 on 8 months' credit. The purchaser paid $\frac{1}{2}$ down, and $\frac{1}{4}$ in 3 months; what time should be allowed him for the payment of the remainder?

$$\begin{array}{rcl}
 \$4000 & \times & 8 = 32000 \\
 2000 & \times & 0 = 0 \\
 1000 & \times & 3 = 3000 \\
 \hline
 3000 & & 3000 \\
 1000 &) & 29000
 \end{array}
 \begin{array}{l}
 \text{subtract from 32000} \\
 (\quad 29 \text{ months} = \\
 \quad 2 \text{ years, 5 months.}
 \end{array}$$

AVERAGING ACCOUNTS.

The buyer, by the terms of the purchase, is entitled to the use or interest of \$4000 for 8 months, which is the same as the interest of \$1 for 32000 months. He has received on the first \$2000 no credit, and only 3 months on the \$1000 paid. This is equal to the interest of \$1 for 3000 months. He has, therefore, to receive on the remaining \$1000 what is equal to the use of \$1 for 29000 months. But the interest of \$1 for 29000 months is the same as the interest of \$1000 for the $\frac{1}{1000}$ part of 29000 months, which is 29 months, or 2 years, 5 months.

EXAMPLE 2.—A merchant sold W. M. Brown, Esq., goods to the amount of \$3051, on a credit of 6 months from Sept. 25th, 1883. October 4, Mr. Brown paid \$476; Nov. 12, \$375; Dec. 5, \$800; and on Jan. 2nd, 1884, \$200. When, in equity, ought the merchant to receive the balance?

OPERATION.

	m.	d.				
Sep. 25, \$3051	$\times 6$	25 =	18306	product for	6 mos.	
			2440	"	"	24 d.
			102	"	"	1 d.
			20848			
Oct. 4,	476	$\times 1$ 4 =	476	"	"	1 mo.
			48	"	"	3 d.
			16	"	"	1 d.
Nov. 12,	375	$\times 2$ 12 =	750	"	"	2 mos.
			152	"	"	12 d.
Dec. 5,	800	$\times 3$ 5 =	2400	"	"	3 mos.
			133	"	"	5 d.
Jan. 2,	200	$\times 4$ 2 =	800	"	"	4 mos.
			13	"	"	2 d.
			1851			
			1200			
		12)				
			160.60	(		
			13.38			
			30			
			11.40			

13 mos. 12 days from the beginning of September, 1883, which will be October 12th, 1884.

The interest on the Dr. side from the beginning of September is equal to the interest of \$1 for 20848 months. The interest on the Cr. side from the same date is equal to the interest of \$1 for 4788 months, which leaves a difference in favor of the Cr. side of the interest of \$1 for 16060 months; that is, the interest of the balance, \$1200, for the $\frac{1}{12}$ part of 16060 months, or 13 mos. and more than 11 days. Therefore, Mr. Brown is entitled to the use of the balance to October 12th, 1884,—13 months and 11 + days from the beginning of September, 1883.

EXAMPLE 3.—When did the balance of the following account fall due, the merchandise items being on 4 mos. credit?

Dr.				MACDONALD BROS.				Cr.			
1882.						1883.					
May	15	To Mdse.,		350	75	June	9	By Mdse.,		200	00
July	20	" "		185	10	1883.					
Sept.	27	" "		431	73	Feby.	18	" Cash,		300	00
						Mar.	8	" Mdse.,		290	00

OPERATION.

May	15	— 4 —	350.75	×	4.15	=	1404	product for 4 mos.
							175	" " 15 d.
July	20	— 4 —	185.10	×	6.20	=	1110	" " 6 mos.
							62	" " 10 d.
							61	" " 10 d.
Sept.	27	— 4 —	431.73	×	8.27	=	3456	" " 8 mos.
							387	" " 27 d.
			967.53				6656	
June	9	— 4 —	200	×	5.9	=	1000	" " 5 mos.
							60	" " 9 d.
Feby.	18	—	300	×	9.18	=	2700	" " 9 mos.
							180	" " 18 d.
Mar.	8	— 4 —	290	×	14.8	=	4060	" " 14 mos.
							.58	" " 6 d.
							19	" " 2 d.
			790				8077	
			177.53	)			1422	(8 months.

8 months, to be counted *backward* from the beginning of May, 1882, which gives August 31, 1881, the time from which interest is to be charged on the balance.

The interest on the debit side, from the beginning of May, 1882, is equal to the interest of \$1 for 6655 months, while the interest on the credit side from the same date is equal to the interest of \$1 for 8077 months, which gives a difference in favor of the debit side, of the interest of \$1 for 1422 months, equal to the interest of the balance, \$178, for $1\frac{1}{8}$ part of 1422 months, that is 8 months.

From the above examples we may deduce the following:

RULE.—*Proceed with each side of the account as in Equation of Payments, counting the time for each side, from the beginning of the month of the earliest date in the account.*

Take the difference between the sums of the products of the two sides, and divide it by the balance of the account. Count the quotient months, and carry it to two places of decimals. Reduce the decimals to days.

When the sum of the products of the larger side is greater than the sum of the products of the smaller side, reckon the time denoted by the quotient FORWARD, but when the opposite of this is the case, reckon BACKWARD from the date from which all the time has been reckoned.

EXEROISES.

Find the times at which the balances of the following accounts became due, or subject to interest:—

1. Dr.	J. S. PECKHAM.	Cr.
May 16, 1882	\$724.45 | July 29th, 1882	\$486.80.
2. Dr.	T. B. REACH.	Cr.
November 19, 1883	\$635. | December 12, 1883	\$950.
3. Dr.	JNO. T. LITHGOW & Co.	Cr.
February 24, 1883	\$512.25 June 10, 1882	\$309.70.
4. Dr.	T. J. GOLDEN & Co.	Cr.
March 17, 1883	\$145. January 15, 1883	\$695.60.

EXERCISES.

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5. Dr.	S. E. WHISTON.	Cr.
August 27, 1883.....	\$341.	November 7, 1883....\$247.
6. Dr.	L. C. EATON.	Cr.
July 20, 1883.....	\$711.	April 14, 1883.....\$1260.
7. Dr.	GORDON & KEITH.	Cr.
June 24, 1882	\$1418.	| September 7, 1883 ....\$2346.
8. Dr.	GEO. W. JONES.	Cr.
December 2, 1883....	\$1040.80.	| August 13, 1883....\$1112.40.

9. Required the time when the balance of the following account became subject to interest, allowing the merchandise items to have been on 8 months' credit?

Dr. S. T. HALL & Co. Cr.

1882.					1883.				
May	1	To Mdse.,	\$300	00	Jan.	1	By Cash,	\$500	00
July	7	" "	759	96	Feb.	18	" Mdse.	481	75
Sept.	11	" "	417	20	Mar.	19	" Cash,	750	25
Nov.	25	" "	287	70	Apr'l.	1	" Draft,	210	00
Dec.	20	" "	571	10	May.	25	" Cash,	100	00

10. When did the balance of the following account fall due, the merchandise items being on 6 months' credit?

Dr. BARNES & Co. Cr.

1883.					1883.				
May	1	To Mdse.,	\$312	40	June	14	By Cash,	\$200	00
May	23	" "	85	70	July	30	" Mdse.,	185	90
June	12	" cash pd dt.	105	00	Aug.	10	" Cash,	100	00
July	29	" Mdse.,	243	80	Aug.	21	" Mdse.,	58	00
Aug.	4	" "	92	10	Sept.	23	" "	45	10
Sept.	18	" Cash,	50	00					

11. When did the balance of the following account become subject to interest?

Dr. BEARD & VENNING. Cr.

1882.					1882.				
Aug.	10	To Mdse., 4 mos.	285	36	Oct.	13	By Cash	400	00
	17	" " 2 "	192	60		26	" "	150	00
Sept.	21	" " 1 "	256	80	Dec.	15	" Mdse., 2 mos.	345	80
Oct.	13	" Cash,	190	00		30	" " 4 "	230	40
Nov.	25	" Mdse., 6 "	432	20					
	30	" " 3 "	215	25					
Dec.	18	" " 2 "	68	90					

AVERAGING ACCOUNTS.

12. In the following acct., when did the balance become due, the merchandise being on 6 months' credit?

Dr. S. M. KERR in acct. with T. R. JONES & Co. Cr.

1883.					1883.				
Jan.	4	To Mdse.,	96	57	Jan.	30	By Cash,	240	00
	18	" "	57	67	April	3	" "	48	88
< Feb.	4	" Cash,	80	00	May	22	" "	50	00
		" Mdse.,	38	96					
	9	" Cash,	50	26					
Mar.	3	" Mdse.,	154	46					
	24	" "	42	30					
April	9	" "	23	60					
May	15	" "	28	46					
	21	" "	177	19					

13. When, in equity, should the balance of the following account be paid?

Dr. DANIEL & BOYD. Cr.

1883.					1882.				
Jan.	3	To Cash,	200	00	Sept.	20	By Mdse., 6 mos.	583	17
	31	" "	300	00	Oct.	27	" " 4 "	321	00
< Feb.	8	" "	75	00	Dec.	5	" " 1 "	137	00
	21	" "	100	00	1884.				
Mar.	10	" "	350	00	Jan.	18	" " 2 "	98	75
	24	" "	25	00	Feb.	26	" " 6 "	53	98
April	12	" "	40	00	April	15	" " 4 "	634	00
June	1	" "	80	00	June	12	" " 2 "	97	23
	20	" "	125	00	Sept.	21	" " 6 "	84	00
July	4	" "	268	00	Dec.	29	" " 6 "	132	14
Sept.	27	" "	250	00					
Dec.	9	" "	100	00					

ACCOUNTS SALES.

An **Account Sales** is a detailed statement of the sales, expenses and charges of a consignment. It should show the dates and particulars of the sales, the dates and particulars of the charges and the net proceeds and when they are due.

The **Net Proceeds** is the sum to be paid the consignor from the sales after all charges have been deducted, and is payable at the average date of the whole account.

In averaging an account sales, the sales are considered as one side, and the charges the other, the averaging being done the same as in any other account.

As to when the commission should be considered due, whether at the average date of the sales, or at their average due date, or on the completion of the sales, there may be some difference of opinion. In the exercises here given this charge is considered due at the date of the last sale when the acct. sales is supposed to be made out. The small amount of the commission compared with the sales renders it of little practical moment, which of these dates is taken as its due date.

Commission merchants often become interested in the merchandise consigned to them for sale, by accepting a certain share, and selling on joint account of themselves and their consignors. When this is the case the terms on which the consignor becomes responsible for his share should be known, whether payable as cash, on some definite term of credit, or at the average date of the Acct. Sales.

Many commission merchants do not average their accounts, some because they do not know how, and others prefer, as affording more profit and less trouble, to retain a percentage for prompt payment, and pay over the net proceeds, or place the same to the Cr. of their consignors on completion of the sales.

1. In the following acct. sales at what date are the net proceeds due as cash, and what sum will settle the same on June 30th, 1883, interest at 7 %?

Acct. Sales of 8745 lbs. Bacon, 2976 lbs. cheese and 1245 lbs. butter for acct and risk of E. A. Donkin, Amherst?

AVERAGING ACCOUNTS.

1883.									
Mar.	10	4000 lbs. Bacon	} 30 days	13 c.	520	00			
		500 " Butter		21 c.	105	00	625	00	
April	20	4745 " Bacon, Cash		12 1/2 c.			604	99	
May	14	2976 " Cheese	} 60 days	16 c.	476	16			
		745 " Butter		22 c.	163	90	640	06	
							\$1870	05	
CHARGES.									
Mar.	1	Paid freight and cartage.....		28	10				
	9	" labor re-salting Bacon		8	50				
May	14	Storage and Advertising.....		5	00				
		Commission @ 2 1/2 % on \$1870.05.....		46	75		88	35	
		Net Proceeds due as per av. (due date)					\$1781	70	
		E. & O. E.							
		Halifax, May 14, 1883.							
		R. FELTON & Co.							

2. September 4, 1882, we received from W. Cummings, Brantford, Ont., 120 bbls. Mess Pork and 742 bushel Clover Seed to be sold for his acct, and on the same day we accepted his 60 days sight draft for \$3450. The following is the account sales. What are the net proceeds and when due, and what is the cash balance of W. Cummings's account on December 31, 1882.— interest at 6 %?

Acct. Sales of 120 bbls. Mess Pork and 742 bush. Clover Seed, for acct. and risk of W. Cummings, Brantford, Ont.

1882.									
Sept.	12	250 bush. Clover Seed, Cash,	\$3.20						
	30	25 bbls. Mess Pork	21.00						
		50 bush. Clover Seed } 60 days	3.30						
Oct.	18	200 " " " }	3.18						
		10 bbls. Mess Pork } 30 days	21.50						
Nov.	2	200 bush. Clover Seed, Cash,	3.15						
	15	85 bbls. Mess Pork	20.75						
		12 bush. Clover Seed } 6 m	3.50						
CHARGES.									
Sept.	4	Paid freight and cartage.....	210	75					
		" Insurance on \$4500 @ 1 1/2 %.....							
Oct.	8	Storage and Advertising.....	15	00					
Nov.	15	Comm'n. @ 2 1/2 % on Sales.....							
		Net proceeds due as per av.....							
		E. & O. E.							
		Halifax, Nov. 15, 1882.							
		JAS. A. BURY & Co.							

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Jan. 21, Cashed B. Bremner & Co.'s sight draft payable to their order for \$1264.50. Feby. 14, Accepted B. Bremner & Co.'s one month's sight draft favor A. Gunn & Co., Halifax, for \$864.

Find average date for payment of the net proceeds, per the following acct. sales, the average date for payment of the balance of B. Bremner & Co's acct., and the cash balance of their acct. on May 14, 1883.

1883.						
Jan.	16	40 bbls. Pork 50 firkins Butter, 4028 lbs. }	3 mos.	18.75 24 c.	.....	.....
Feb.	9	60 bbls. Pork 1150 lbs. Cheese }	2 mos.	19.37½ 13 c.	.....	.....
	27	50 firkins Butter, 4025 lbs. 1896 lbs. Cheese }	3 mos.	24 c. 14 c.	.....	.....
Mar.	7	75 bbls. Pork, Cash,		19.25	.....	.....
	24	25 bbls. Pork 705 lbs. Cheese }	1 mo.	19.87½ 15 c.	.....	.....
CHARGES.						
Jan.	2	Paid freight, &c.....		122 75	.....	.....
	14	" cooperage, &c.....		6 50	.....	.....
	15	" Insurance @ 1½ % on \$5000.....		.....	.....	.....
	24	Storage.....		11 25	.....	.....
		Comm'n. @ 2½ % on sales.....		.....	.....	.....
Net proceeds of sales.....						
¾ n. p. due B. Breinmer & Co., per average.						
E. & O. E.						
Halifax, March 24th, 1883.						
T. A. MACLEOD & CO.						

STATEMENT.

HALIFAX, March 24th, 1883.

Messrs. B. BREMNER & Co.,

In acct. with T. A. MACLEOD & Co.

1882.						
Jan.	2	By	Inv. of Shipment due Dec. 27, 1882.....	1751	67	
Mar.	24	"	Net pro. do. " April 19, 1883.....	3955	49	
			DR.	5707	16	
Jan.	21	To	Cash paid sight draft.....	\$1264.50		
Feb.	14	"	Acceptance, 1 mo., due March 17.....	864.00		
	28	"	Cash, paid sight draft.....	1174.75	3303	25
			Bal. due B. B. & Co., April 22, 1883.....	\$2403	91	

4. December 1, 1882, Received from Messrs. Gillespie, Moffatt & Co., Boston, per str. Canima, to be sold on joint acct. of consignor and consignee each one half, my half due as cash Feb. 24, 1883.

27 cases Mackinaw Blankets, 540 pairs @ \$3.20, weight 3510 lbs., duty $7\frac{1}{2}$ c. per lb. and 20 % *ad val.*; 2 cases Factory Cotton, 987 yds., 1 yd. wide, @ $7\frac{3}{4}$ c, duty 1c. per square yard, and 15 % *ad val.*; 20 pieces Table Oil Cloth @ \$3.70, duty 30 %; 126 yds. W. E. Broad Cloth @ \$3.00, weight 284 lbs, duty $7\frac{1}{2}$ c. per lb, and 20 % *ad val.*; 7 bales Cotton Batts @ \$6.20, weight 312 lbs., duty 2c. per lb. and 15 % *ad val.*

December 5, Cashed their draft for \$1200.

" 17, Accepted their draft at 30 days' sight for \$684.

Jan. 14, 1883, Cashed their draft for \$500.

Make out Gillespie, Moffatt & Co.'s acct. current and interest acct. to March 31, 1883, (interest at 7 %). What is the balance on that date?

The following is the account sales :—

AVERAGING ACCOUNTS.

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Acct. Sales. Merchandise on joint acct. of Gillespie, Moffatt & Co., Boston, and myself each one half.

1882.						
Dec.	5	Cash.				
		260 prs. Blankets	4.20			
		425 yds. Cotton	9			
		7 pcs. Table Oil Cloth	4.50			
	9	Note at 6 mos.				
		140 prs. Blankets'	4.50			
		54 yds. Broad Cloth	4.20			
		4 pcs. Table Oilcloth	6.00			
	14	Cash.				
		562 yds. Cotton	9			
		13 pcs. Table Oilcloth	4.40			
		54 yds. Broad Cloth	4.00			
	17	Note at 3 mos.				
		2 bales Cotton Batts	7.00			
		80 prs. Blankets	6.70			
		18 yds. Broadcloth	5.00			
	28	Cash $\frac{1}{2}$, Acct. 30 days $\frac{1}{2}$.				
		60 prs. Blankets	6.75			
		5 bales Cotton Batts	7.25			
		CHARGES.				
Dec.	1	Duties		761	46	
		Freight, &c.		94	74	
	28	Commission @ 5 % on sales				
		Net proceeds				\$2419 00
		Half n. p. due as per av.				\$
		E. & O. E.				
		Halifax, Dec. 28, 1882.				
		G. A. MURDOCH.				

RATIO AND PROPORTION.

DEFINITIONS.

Ratio is the relation which one quantity bears to another of the same kind in respect to magnitude.

Thus, the ratio of 2 to 6 is the relation which 2 bears to 6 in respect to the quantity expressed by each, and since 2 is $\frac{1}{3}$ of 6, this ratio is equal to $\frac{1}{3}$.

Hence the ratio of one number or quantity to another is measured by the quotient obtained by dividing the first by the second.

Thus the ratio of 4 to 8 is $\frac{1}{2}$; of 5 to 20 is $\frac{1}{4}$; of 12 to 6 is 2; of 27 to 3, 9.

Ratio is generally expressed by the sign : placed between the quantities. Thus 3 : 12 expresses the ratio of 3 to 12, and is equal to $\frac{1}{4}$.

The two numbers or quantities of a ratio are called its **Terms**.

The first term is called the **Antecedent**, the second the **Consequent**.

A **Simple Ratio** is an expression of the relation of two quantities only, as 7 : 21.

A **Compound Ratio** is a combination of two or more simple ratios as, $\left\{ \begin{array}{l} 3 : 6, \\ 2 : 3. \end{array} \right\}$

A compound ratio is reduced to a simple one by multiplication.

Thus, $\left\{ \begin{array}{l} 3 : 6 \\ 2 : 3 \end{array} \right\} = 6 : 18$, or $\frac{3}{2} \times \frac{6}{3} = \frac{18}{3} = 6 : 18$.

Also, $\left\{ \begin{array}{l} 5 : 8 \\ 4 : 5 \\ 6 : 3 \end{array} \right\} = 120 : 120$, or $\frac{5}{4} \times \frac{4}{5} \times \frac{8}{6} = \frac{120}{1} = 120 : 120$.

A **Ratio of Equality** is one in which the antecedent is equal to the consequent, as 7 : 7.

A **Ratio of Majority** is one in which the antecedent is greater than the consequent, as $12 : 8$.

A **Ratio of Minority** is one in which the antecedent is less than the consequent, as $8 : 24$.

Proportion is an expression of two or more ratios equal to one another.

A **Proportion or Analogy** is an expression of the equality of two ratios.

A **Simple Proportion** expresses the equality of two simple ratios, usually by means of the sign, ($::$). Thus, $2 : 4 :: 7 : 14$, which indicates that the ratio of 2 to 4 is equal to the ratio of 7 to 14, and is read, 2 is to 4 as 7 to 14.

The four quantities of a simple proportion are called its **terms**.

The first and fourth terms are called the **Extremes**; the second and third, the **Means**.

In every proportion the product of the **Extremes** is equal to the product of the **Means**.

The fourth term is generally known as the **Fourth Proportional**.

To find a fourth proportional, the first three terms being given.

RULE.—*Multiply the second and third terms together, and divide the product by the first.*

EXAMPLE.—What is the fourth proportional to 3, 21 and 10?

Multiply the means together, $21 \times 10 = 210$. Now, since the product of the means is the same as the product of the extremes, the number, 210, is the product of two factors, one of which is 3. Therefore, if 210 be divided by 3, the quotient will be the other extreme, or fourth proportional. $210 \div 3 = 70$, Ans.

EXERCISES.

1. Find the fourth proportional to 5, 15 and 24.
2. Find the fourth proportional to 17, 34 and 19.
3. What is the fourth proportional to 9, 36 and 48?
4. What is the fourth proportional to 8, 48 and 72?

Whenever the first term, or any factor of it, is a factor of one of the others, the operation may be shortened by cancelling.

Thus, in the last question, where the first term is a factor of both the others :

$$\begin{array}{ccc} 8 : 48 :: 72, & \text{or,} & 8 : 48 :: 72 \\ 6 & 6 & 9 \quad 9 \\ \hline 432 & \text{Ans.} & 432 \quad \text{Ans.} \end{array}$$

5. Find the fourth proportional to 27, 72, 31.

$$\begin{array}{ccc} 27 : 72 :: 31 & 9 \text{ is a factor of the first and second terms.} \\ 3 & 8 & \end{array}$$

6. Find the fourth proportional to 16, 27, 56.

$$\begin{array}{ccc} 16 : 27 :: 56 & 8 \text{ is a factor of the first and third terms.} \\ 2 & 7 & \end{array}$$

7. Find the fourth proportional to 14, 21, 32.

8. Find the fourth proportional to 22, 37, 363.

9. What is the fourth proportional to 9, 19, 99.

The following principles will be found useful to the learner.

In the following, or any other proportion :—

$$8 : 6 :: 12 : 9.$$

By *inversion*, the second is to the first as the fourth to the third, thus,

$$6 : 8 :: 9 : 12.$$

By *alternation*, the first is to the third as the second to the fourth, thus,

$$8 : 12 :: 6 : 9.$$

By *composition*, the sum of the first and second is to the second as the sum of the third and fourth is to the fourth, thus,

$$14 : 6 :: 21 : 9.$$

By *addition*, the first is to the sum of the first and second as the third is to the sum of the third and fourth, thus,

$$8 : 16 :: 12 : 21.$$

By *division*, the difference between the first and second is to the second, as the difference between the third and fourth is to the fourth, thus,

$$2 : 6 :: 3 : 9.$$

By *conversion*, the first is to the difference between the first and second, as the third is to the difference between the third and fourth, thus,

$$8 : 2 :: 12 : 3.$$

By *mixing*, the sum of the first and second is to their difference, as the sum of the third and fourth is to their difference, thus,

$$14 : 2 :: 21 : 3.$$

SOLUTION OF QUESTIONS BY SIMPLE PROPORTION.

Questions to be solved by Simple Proportion contain, or indicate, three terms, two of which are alike, and are to be taken as the terms of one ratio; and the third is of the same kind as the required answer, and between which and the answer there exists, by the nature of things, the same ratio as between the first two.

If 3 barrels of apples cost \$7, what will be the price of 12 barrels?

Now, in this question, the two terms, 3 barrels and 12 barrels, are of the same kind,—let them be taken as the terms of a ratio, thus, 3 : 12. This ratio is evidently equal to that of the price of 3 barrels, \$7, to the price of 12 barrels, which is the required answer. We may, therefore, state the question in the form of a proportion, the fourth term of which is to be found. Thus,

3 : 12 :: 7 : the fourth proportional which is obtained by the rule already given.

The completed proportion will be—

bbls.	bbls.	\$	\$
3	: 12	:: 7	: 28.

By examining the the previous examples of Proportion, it will be seen that whenever the fourth term is greater than the third, the second is greater than the first: and whenever the fourth term is less than the third, the second is less than the first. Therefore,

To state questions in Simple Proportion :

RULE.—Place the term, or quantity which is of the same kind as the required answer and may form a ratio with it, in the third place. Then, when the answer, or fourth term, is to be greater than this third

EXERCISES.

term, make the greater of the other two the second term, and the less the first; but when the answer is to be less than the third term, make the less of the other two the second term, and the greater the first.

EXAMPLE.—If 14 reams of paper cost \$44.10, what will 36 reams cost?

$$14 : 36 :: \$44.10$$

36

26460

13230

$$14)158760(\$113.40. \text{ Ans.}$$

EXERCISES.

1. If 6 barrels of flour cost \$32, what will 75 barrels cost?
2. If 18 yards of cloth cost \$21, what must be paid for 12 yards?
3. How much must be paid for 15 tons of coal, if 2 tons can be purchased for \$15?
4. If you can walk 84 miles in 28 hours, how many minutes will you require to walk 1 mile?
5. What will 14 horses cost, if 3 of the average value can be bought for \$270?
6. What must be paid for a certain piece of cloth, if $\frac{2}{3}$ of it cost \$9?
7. If 5 men are required to build a wall in 5 days, how many men will do the same in $2\frac{1}{2}$ days?
8. What must be paid for $4\frac{1}{2}$ cords of wood, if the cost of 3 cords is \$10?
9. What is the height of a tree which casts a shadow of 125 feet, if a post 6 feet high throws a shadow of 8 feet?
10. If a train run at the rate of 5 miles in $15\frac{1}{2}$ minutes, how long would it be in going from Halifax to Truro, a distance of 61 miles?
11. At the rate of \$4.50 for 3 days' work, how long should a man work for \$25?
12. A contractor employs 5 men to do a piece of work which he has agreed to have done in 5 days, but at the end of the fourth

day he finds it will require 3 days more for the men to complete the job. How many additional men must he put on to enable him to finish it in the time agreed upon at first?

13. A bankrupt owes \$972, and his property, amounting to \$607.50 is distributed among his creditors; what does one receive whose claim is \$11.34?

14. What is the value of .15 of a hogshead of lime, @ \$2.40 per hogshead.

15. A garrison of 1200 men has provisions for $\frac{3}{4}$ of a year, how long will the provisions last at the same allowance if the garrison be reinforced by 400 men?

16. A borrowed of B \$745 for 90 days, and would return the the favor by lending B \$1341; for how long should he lend it?

17. If 495 gallons of wine cost \$390, how much will \$72 pay for?

18. If a certain quantity of hay last 112 head of cattle 9 days, how long will the same quantity last 84 head?

19. If 171 men build a house in 168 days, in what time should 108 men build a similar house?

20. How many pounds of tobacco may be bought for \$119.50 if 111 lbs. cost \$89.62 $\frac{1}{2}$?

21. If 110 yds. of cloth cost \$18; how much will \$63 pay for?

22. If 123 yds. muslin cost \$205, how much will 51 yds. cost?

23. If a man walk 78 miles in 27 hours, 54 minutes, how long would it take him to walk 152 miles at the same rate?

24. Suppose a man by travelling 10 hours a day, performs a journey in four weeks without trespassing upon the Sabbath, how many weeks would it take him to perform the same journey provided he travel only 8 hours a day, and pay no regard to the Sabbath?

25. How much may a person spend proportionately in 94 days if he wishes to save during the year \$73.50 out of a salary of \$500 per annum?

26. If 7 watches cost £30 3s. 9d., what will be the cost of 3 dozen of the same kind with 25 % duty added?

27. If 13 dozen hats cost £37 14s., what will be the price of 5 $\frac{1}{2}$ dozen?

28. If 3 cwt. 3 qra. 14 lbs. of sugar cost \$36.50, what will 2 qra., 2 lbs. cost?
29. A wedge of gold weighing 14 lbs. 3 oz. 8 pwt. is valued at £514 4s., what is the value of 6 oz. 10 pwt.?
30. If the carriage of 3 cwt. 1 qr. 18 lbs. from Liverpool to Halifax cost 6/11, what at the same rate will be the freight for 2 tons 16 cwt. 2 qra.
31. A cubic foot of pure fresh water weighs 1000 oz. avoirdupois; find the weight of a vessel of water containing $217\frac{1}{2}$ cubic inches.
32. A butcher used a false weight, $14\frac{1}{2}$ oz. instead of 16 oz. for a pound; of how many lbs. did he defraud a customer who bought what, if it had been properly weighed, would have been 112 lbs. from him?
33. If a long ton of coal is worth \$4.75, what is the value of a short ton (2000 lbs.)?
34. A citizen whose property is assessed at \$42500 is taxed \$403.75, what should a citizen pay whose property is assessed at \$3600?
35. Find the value of 7 tons, 9 cwt., 3 qra., 20 lbs. of iron @ 85 shillings per ton.
36. A watch was 10 minutes fast at 12 o'clock (noon) on Monday, and gained at the rate of 3 minutes 10 seconds a day; what was the reading of the watch at a quarter past 10 a. m. on the following Saturday?
37. A was sent with a warrant, and when he had ridden 65 miles B was sent after him to stop the execution, and for every 16 miles that A rode B rode 21 miles. How far had each ridden when B overtook A?
38. A detective, travelling at the rate of 8 miles per hour, chased a culprit, and caught him at the end of 200 miles, but the culprit had a start of 75 miles. At what rate did the latter travel?
39. A mason engaged in building a wall ascertained at the end of a certain time that the part he had finished bore the same proportion to 3 miles that $\frac{1}{2}$ does to 87. How many feet had he laid?
40. A farmer by his will divides his farm consisting of 97 acres, 3 roods, 5 rods between his two sons so that the share of the younger is $\frac{2}{3}$ of the share of the elder. Required the shares.

41. A legacy of \$398 is to be divided among three orphans, in parts which shall be to one another as the numbers 5, 7, 11; the eldest receiving the largest share. Required the parts.

42. Divide \$5000 among A, B and C, so that B's share may be one half greater than A's and C's one half greater than B's.

43. Suppose that A starts from M. and walks 4 miles an hour towards N., and at the same time B starts from N. and walks towards M. at the rate of 3 miles an hour. M. and N. being distant 432 miles, how far will A have travelled when he meets B?

44. A certain sum being divided among two persons, it was found that the less share was $\frac{2}{3}$ the greater, and the difference of the share was \$800. What was the whole sum divided, and what were the shares?

45. A parcel of land is to be divided into two parts such that one shall be $\frac{3}{4}$ of the other, and the difference of the parts 716 acres. Required the whole, and the parts.

46. In a mixture of copper and tin the tin is $\frac{1}{2}$ the copper, and the difference of the parts is 75 lbs. Required the whole, and the parts.

47. Pure water consists of two gasses,—oxygen and hydrogen; the hydrogen is about $\frac{1}{8}$ of the oxygen. How many pounds of water will there be when there are 764 $\frac{1}{2}$ oz. of oxygen more than of hydrogen?

COMPOUND PROPORTION.

Compound Proportion is used in the solution of questions, each of which involves more than one condition.

EXAMPLE.—If a man walking 12 hours a day can accomplish a journey of 250 miles in 9 days, how many hours a day would he require to walk 400 miles provided he walk at the same rate 10 hours a day?

In this question there are two conditions, viz., *first*, that in the one case he travels 12 hours a day, and in the other 10 hours; and, *secondly*, that the distances are in one case 250 miles, and in the other 400 miles. It may be solved by two statements of Simple Proportion. Thus,

10 : 12 :: 9 days : 10.8 days
and
250 : 400 :: 10.8 days : 17 $\frac{2}{3}$ days. Ans.

But by a combination of the ratios which express the two conditions, the solution may be attained by one statement of Compound Proportion. Thus,

$$\begin{array}{lcl} 10 & : & 12 \\ 250 & : & 400 \end{array} \left. \vphantom{\begin{array}{l} 10 \\ 250 \end{array}} \right\} :: 9 \text{ days} : 17\frac{7}{8} \text{ days. Ans.}$$

To state the question.

RULE.—Place the term which is of the same kind as the answer in the third place. Then consider the conditions separately, and place the ratio expressing each as in Simple Proportion.

To work out the question.

RULE.—Multiply all the means together for a dividend, and divide it by the product of the extremes given: the quotient will be the required extreme, or answer.

NOTE.—Whenever it can be done cancel the factors of the divisor against those of the dividend.

EXAMPLE.—If \$35.10 pay 27 men for 24 days, how much will pay 16 men for 18 days?

OPERATION.

$$\begin{array}{rcl} 3 & 2 & \$ \text{ cts.} \\ 27 & : & 18 \\ 24 & : & 16 \\ 3 & 2 & 35.10 \\ & & 11.70 \\ & & 3.90 \\ & & 4 \end{array}$$

\$15.60. Ans.

By reading the question we observe that the answer is to be money, and as there is only one term of that kind, we take that for the third term, or the antecedent of the ratio of which the answer is the consequent. Then take two terms of the same kind, as

27 men and 16 men, and observe that \$35.10 pay for 27 men, and it is evident that a less sum will pay for 16 men not considering the difference of time. We therefore place the less of these terms, 16, in the second place, and the greater in the first. Next take the other two terms of the same kind and observe that \$35.10 pays for 24 days, and a less sum is required to pay for 18 days, therefore we place the less of these, 18, in the second place, and the greater in the first.

To work out: First it is seen that 9 is a factor of 27 and 18. Cancel these terms by 9, and use instead the quotients 3 and 2. In like manner 8 will cancel 24 and 16, leaving the quotients 3 and 2. Then 3 will cancel itself and \$35.10, leaving 1 and \$11.70, and the other 3 will cancel itself and \$11.70, leaving 1 and \$3.90. This completes the cancelling because the divisor is reduced to 1. Now multiply the uncanceled quotient of the third term \$3.90 by the remaining other factors of the dividend, and because there is no divisor this product is the answer

EXERCISES.

1. If I pay 16 men \$62.40 for 18 days work, each, how much should I pay 27 men for 10 days work, each?
2. If \$42 keep a family of 8 persons for 16 days, how long at that rate will \$100 keep a family of 6 persons?
3. If the freight of 10800 lbs. of flour be \$16 for 20 miles, how much will it be for 12500 lbs. for 100 miles?
4. If 120 yds. of carpet, 5 quarters wide, cost \$60, what should be the price of 36 yds. of the same quality, 7 quarters wide?
5. If 48 men can build a wall 864 feet long, 6 feet high, and 3 feet wide, in 36 days; how many men will be required to build a wall 36 feet long, 8 feet high, and 4 feet wide, in 4 days?
6. Suppose that 50 men, working 5 hours a day, can dig in 27 days, 18 cellars which are each 48 feet long, 28 feet wide, and 15 feet deep; how many days will 50 men require, working 3 hours each day, to dig 24 cellars which are each 36 feet long, 21 feet wide, and 20 feet deep?
7. If 60 men can build a wall 300 feet long, 8 feet high, and 6 feet thick in 120 days of 8 hours each; in what time would 12 men build a wall 30 feet long, 6 feet high, and 3 feet thick, working 12 hours each day?
8. If 24 men, in 132 days, of 9 hours each, dig a trench of four degrees of hardness, $337\frac{1}{2}$ feet long, $5\frac{3}{4}$ feet wide, and $3\frac{1}{2}$ feet deep; in how many days, of 11 hours each, will 496 men dig a trench of 7 degrees of hardness, 465 feet long, $3\frac{3}{4}$ feet wide, and $2\frac{1}{4}$ feet deep?
9. If 50 men, by working 3 hours each day, can dig, in 45 days, 24 cellars, which are each 36 feet long, 21 feet wide, and 20 feet deep; how many men would be required to dig, in 27 days, working 5 hours each day, 18 cellars, which are each 48 feet long, 28 feet wide, and 15 feet deep?
10. If 9 compositors, in 12 days, working 10 hours each day, can compose 36 sheets of 16 pages to a sheet, 50 lines to a page, and 45 letters in a line; in how many days, each 11 hours long, can 5 compositors compose a volume, consisting of 25 sheets, of 24 pages in a sheet, 44 lines in a page, and 40 letters in a line?

11. If 48 men, in 5 days of $12\frac{1}{2}$ hours each, can dig a canal $139\frac{3}{4}$ yards long, $4\frac{1}{2}$ yards wide, and $2\frac{1}{2}$ yards deep; how many hours per day must 90 men work for 42 days to dig one $491\frac{1}{8}$ yards long, $4\frac{7}{8}$ yards wide, and $3\frac{1}{2}$ yards deep?

12. If 112 men can seed 460 acres, 3 roods, 8 rods, in 6 days; how many men will be required to seed 72 acres in 5 days?

13. If 15 bars of iron, each 6 ft. 6 in. long, 4 in. broad, and 3 in. thick weigh 20 cwt., 3 qrs., 16 lbs.; how much will 6 bars 4 ft. long, 3 in. broad, and 2 in. thick, weigh?

14. If the freight by railway of 3 cwt. for 65 miles be \$11.25; how far should $35\frac{3}{4}$ cwt. be carried for \$18.75?

15. If 126 lbs. of tea cost \$56.70; what will 68 lbs. of a different quality cost, 9 lbs. of the former being equal in value to 10 lbs. of the latter?

16. If 15 men, working 12 hours a day, can reap 60 acres in 16 days; in what time would 20 boys, working 10 hours a day, reap 98 acres, if 7 men can do as much as 8 boys in the same time?

QUESTIONS TO BE SOLVED BY ANALYSIS.

Analysis in Arithmetic is the process of solving problems by steps of reasoning, each of which is so simple as to be self-evident. It therefore requires no rule, but each person must seek to discern the steps of reasoning, and follow them to the required result.

EXAMPLE.—If 12 lbs. of sugar cost \$1.80, what will 7 lbs. cost?

SOLUTION.

12) \$1.80 cost of 12 lbs.
 .15 cost of 1 lb.
 7

—————
 \$1.05 cost of 7 lbs.

If 12 lbs. cost \$1.80, 1 lb. will cost $\frac{1}{12}$ of \$1.80, which is 15 cents; and if 1 lb. costs 15 cents, 7 lbs. will cost 7 times 15 cents—\$1.05. Ans.

1. If 5 bushels of pease cost \$5.50, what should 19 bushels cost?

2. If 9 men can perform a certain piece of work in 17 days, how long would it take 4 men to do it?

3. How many pigs, at \$2 each, must be given for 7 sheep, worth \$4 a head?

4. If \$100 gain \$6 interest in 12 months; how much would it gain in 40 months?
5. A man bought $\frac{7}{8}$ of a yard of cloth for \$2.80; what was the rate per yard?
6. Suppose I pay \$55 for $\frac{5}{8}$ of an acre of land; what is that per acre?
7. If $\frac{4}{5}$ of a pound of tea cost \$1.66 $\frac{2}{3}$; what will $\frac{7}{8}$ of a pound cost?
8. If $\frac{7}{8}$ of pound cost 23 $\frac{3}{4}$ cents; what will 2 $\frac{1}{2}$ lbs. cost?
9. If $\frac{7}{8}$ of a pound cost \$ $\frac{3}{8}$; what will $\frac{1}{2}$ of a pound cost?
10. If \$1 $\frac{1}{2}$ pay for 1 $\frac{1}{2}$ stone of flour; for how much will \$ $\frac{5}{8}$ pay?
11. If 8 $\frac{3}{4}$ yards of silk make a dress, and 9 dresses be made from a piece containing 80 yards; what will be the length of the remnant?
12. What will be the cost of 8 cwt., 3 qrs., 14 lbs. of beef, if 4 cwt. cost \$34?
13. If 4 $\frac{2}{3}$ bushels of apples cost \$3 $\frac{1}{2}$; what will be the cost of 7 $\frac{1}{2}$ bushels?
14. If $\frac{2}{3}$ of 3 $\frac{3}{4}$ lbs. of tea cost \$1 $\frac{7}{8}$; what will be the cost of 5 $\frac{1}{2}$ lbs.?
15. If $\frac{4}{5}$ of a mine cost \$2800; what is the value of $\frac{2}{3}$ of it?
16. A is 16 years old, and his age is $\frac{2}{3}$ times $\frac{2}{3}$ of his father's age; how old is his father?
17. A and B were playing cards; A lost \$10 which was $\frac{1}{3}$ times $\frac{2}{3}$ as much as B then had; and when they commenced $\frac{2}{3}$ of A's money was equal to $\frac{3}{4}$ of B's; how much had each when they began to play?
18. A man willed to his daughter \$560, which was $\frac{1}{3}$ of $\frac{3}{4}$ of what he bequeathed to his son; and 4 times the son's portion was $\frac{2}{3}$ the value of the father's estate; what was the value of the estate?
19. A gentleman spent $\frac{1}{4}$ of his life in Boston, $\frac{1}{3}$ of it in Montreal, and the remainder, which was 25 years, in Halifax. at what age did he die?
20. A owns $\frac{1}{3}$, and B $\frac{1}{4}$ of a ship; A's part is worth \$650 more than B's; what is the value of the ship?

21. A post stands $\frac{1}{4}$ in the mud, $\frac{1}{3}$ in the water, and 15 feet above the water; what is the length of the post?

22. A grocer bought a firkin of butter containing 56 pounds, for \$11.20, and sold $\frac{3}{4}$ of it for \$8 $\frac{3}{4}$; how much did he get a pound?

23. The head of a fish is 4 feet long, the tail as long as the head and $\frac{1}{3}$ the length of the body, and the body is as long as the head and tail; what is the length of the fish?

24. A and B have the same income; A saves $\frac{1}{4}$ of his income, by spending \$65 a year more than A, finds himself \$25 in debt at the end of 5 years; what did B spend each year?

25. A can do a certain piece of work in 8 days, and B can do the same in 6 days; A commenced and worked alone for 3 days, when B assisted him to complete the job; how long did it take them to finish the work?

26. A and B can build a boat in 18 days, but if C assists them, they can do it in 8 days; how long would it take C to do it alone?

27. A certain pole was 25 $\frac{1}{2}$ feet high, and during a storm it was broken, when $\frac{3}{4}$ of what was broken off, equalled $\frac{2}{3}$ of what remained; how much was broken off, and how much remained?

28. There are 3 pipes leading into a certain cistern; the first will fill it in 15 minutes, the second in 30 minutes, and the third in one hour; in what time will they all fill it together?

29. A cistern has two pipes, one will fill it in 48 minutes, and the other will empty it in 72 minutes; what time will it require to fill the cistern when both are running?

30. If a man spends $\frac{1}{3}$ of his time in working, $\frac{1}{4}$ in sleeping, $\frac{1}{6}$ in eating, and 1 $\frac{1}{2}$ hours each day in reading; how much time will be left?

31. A and B can perform a piece of work in 5 $\frac{1}{4}$ days; B and C in 6 $\frac{3}{4}$ days; and A and C in 6 days; in what time would each of them perform the work alone, and how long would it take them to do the work together?

32. If A can do $\frac{2}{3}$ of a certain piece of work in 4 hours, and B can do $\frac{1}{3}$ of the remainder in 1 hour, and C can finish it in 20 minutes; in what time will they do it all working together?

33. My tailor informs me that it will take $10\frac{1}{2}$ square yards of cloth to make me a full suit of clothes. The cloth I am about to purchase is $1\frac{7}{8}$ yards wide, and on sponging it will shrink $\frac{1}{16}$ in width and length; how many yards of this cloth must I purchase for my "new suit?"

34. A certain tailor in the City of Brooklyn bought 40 yards of broadcloth, $2\frac{1}{4}$ yards wide; but on sponging, it shrunk in length upon every 2 yards, $\frac{1}{16}$ of a yard, and in width, $1\frac{1}{2}$ sixteenths upon every $1\frac{1}{2}$ yards. To line this cloth, he bought flannel $1\frac{1}{2}$ yards wide, which, when wet, shrunk $\frac{1}{2}$ the width on every 10 yards in length, and in width it shrunk $\frac{1}{2}$ of a sixteenth of a yard; how many yards of flannel had the tailor to buy to line his broadcloth?

35. Suppose that a wolf was observed to devour a sheep in $\frac{7}{8}$ of an hour, and a bear in $\frac{3}{4}$ of an hour; how long would it take them together to eat what remained of a sheep after the wolf had been eating $\frac{1}{2}$ an hour?

36. Find the fortunes of A, B, C, D, E, and F, by knowing that A is worth \$20, which is $\frac{1}{4}$ as much as B and C are worth, and that C is worth $\frac{1}{3}$ as much as A and B, and also that if 19 times the sum of A, B and C's fortunes were divided in the proportion of $\frac{2}{3}$, $\frac{1}{2}$ and $\frac{1}{3}$, it would respectively give $\frac{2}{3}$ of D's, $\frac{1}{2}$ of E's, and $\frac{1}{3}$ of F's fortunes.

37. A and B set out from the same place, and in the same direction. A travels uniformly 18 miles per day, and after 9 days turns and goes back as far as B has travelled during those 9 days; he then turns again, and pursuing his journey, overtakes B $22\frac{1}{2}$ days after the time they first set out. It is required to find the rate at which B uniformly travelled.

38. A hare starts 40 yards before a greyhound, and is not perceived by him until she has been running 40 seconds, she scuds away at the rate of 10 miles an hour, and the dog pursues her at the rate of 18 miles an hour; how long will the chase last, and what distance will the hare have run?

39. A can do a certain piece of work in 9 days, and B can do the same in 12 days; they work together for 3 days, when A is taken sick and leaves, B continues on working alone, and after 2

days he is joined by C, and they finish it together in $1\frac{1}{2}$ days; how long would C be doing it alone?

40. A and B start together by railway train from St. John for Moncton, a distance of (say) 100 miles. A goes by freight train, at the rate of 12 miles per hour, and B by mixed train, at the rate of 18 miles per hour, C leaves Moncton for St. John at the same time by express train, which runs at the rate of 22 miles per hour; how far from St. John will A and B each be when C meets them?

41. Required, the sum of the surfaces of 5 boxes, each of which is $5\frac{1}{2}$ feet long, $2\frac{1}{4}$ feet high, and $3\frac{1}{8}$ feet wide, and also the number of cubic feet contained in each box,—the boxes supposed to be made from inch lumber.

42. If I pay $\$1\frac{2}{5}$ per cord for sawing into three pieces wood that is 4 feet long; how much more should I pay, per cord, for sawing into pieces of the same length, wood that is 8 feet long?

43. A sets out from Oswego, on a journey, and travels at the rate of 20 miles a day; 4 days after, B sets out from the same place, and travels the same road, at the rate of 25 miles per day; how many days before B will overtake A?

44. A farmer having $56\frac{1}{2}$ tons of hay, sold $\frac{3}{4}$ of it at $\$10\frac{1}{4}$ per ton, and the remainder at $\$9.75$ per ton; how much did he receive for his hay?

45. A merchant expended $\$840$ for dry goods, and then had remaining only $\frac{3}{4}$ as much money as he had at first; how much money had he at first?

46. Divide $\$1728$ among 17 boys and 15 girls, and give each boy $\frac{7}{11}$ as much as a girl; what sum will each receive?

47. If A can cut 2 cords of wood in $12\frac{1}{4}$ hours, and B can cut 3 cords in $17\frac{1}{2}$ hours; how many cords can they together cut in $24\frac{1}{2}$ hours?

48. A person bought 1000 gallons of spirits for $\$1500$, but 140 gallons having leaked out, at what rate per gallon must he sell the remainder so as to make $\$200$ by his bargain?

49. If it require 30 yards of carpet, which is $\frac{3}{4}$ of a yard wide, to cover a floor; how many yards, which is $1\frac{1}{4}$ yards wide, will cover the same floor? Also what are the dimensions of the room,

allowing the width to be the least possible to permit either piece to be used without waste?

50. If I sell hay at \$1.75 per cwt.; what should I give for $9\frac{1}{2}$ tons that I may gain \$7?

51. How many tons of hay, at $\$16\frac{1}{2}$ per ton, can be bought for $\$196\frac{1}{2}$?

52. A gentleman left his son a fortune, $\frac{1}{2}$ of which he spent in 2 months, $\frac{1}{4}$ of the remainder lasted him 3 months longer, and $\frac{2}{3}$ of what then remained lasted him 5 months longer, when he had only \$895.50 left; how much did his father leave him?

53. A farmer having sheep in two different fields, sold $\frac{1}{4}$ of the number from each field, and had only 102 sheep remaining. Now 12 sheep jumped from the first field into the second; then the number remaining in the first field, was to the number in the second field as 8 to 9; how many sheep were there in each field at first?

54. A and B paid \$120 for 12 acres of pasture for 8 weeks, with an understanding that A should have the grass that was then on the field, and B what grew during the time they were grazing; how many oxen, in equity, can each turn into the pasture, and how much should each pay, providing 4 acres of pasture, together with what grew during the time they were grazing, will keep 12 oxen 6 weeks, and in similar manner, 5 acres will keep 35 oxen 2 weeks?

PARTNERSHIP.

Partnership is the result of a contract by which two or more parties combine their resources for the purpose of carrying on some business or enterprise for their joint benefit.

The persons thus associated are individually called partners, and collectively a Firm, House or Company.

An agreement to enter upon a business and share the profits and losses constitutes a partnership, and this agreement may be written or verbal.

Articles of Copartnership are the written agreement under which the partnership exists.

A Secret Partner is one who is actually a partner by participation in the profits, but who is not avowed or known as such.

A Dormant Partner is one who takes no part in the control of the business of the firm.

A Nominal Partner is one who holds himself out to the world as a member of the firm, but who is not so in fact, having no interest in the profits.

All such parties are liable to creditors for the debts of the firm as if they were in every respect regular partners.

The Resources or Assets are all the property to the extent of its value belonging to the firm, together with the debts owing to the firm by others.

The Liabilities are the debts which the firm owes, and are either direct or certain, or indirect or contingent.

Direct Liabilities are those for which the firm is certainly liable.

Indirect Liabilities are liabilities of others which the firm has guaranteed, and for which its liability is contingent on the good faith or solvency of others.

The Net Capital is the excess of Assets over real liabilities.

The Net Insolvency is the excess of real liabilities over Assets.

NOTE.—The last two definitions do not include as liabilities the partners' investments. The net capitals of the partners are liabilities of the firm, and when ascertained and added to the other liabilities make the total liabilities equal to the assets. The amounts drawn out by the partners are not assets in any other than a constructive sense.

The Net Gain for any given period is the excess of gains over losses during that period; or it is the amount by which the net capital at the end of the period exceeds the net capital at the beginning of the period.

The Net Loss for any given period is the excess of losses over gains during that period; or it is the amount by which the net capital at the beginning of the period exceeds the net capital at the end of the period.

The share of the net profits which each partner is to receive is generally determined beforehand by agreement, and is equitably in proportion to his entire contribution in money, labor, skill, &c., to the resources and management of the business, as compared with the total amount of such resources engaged.

EXAMPLE.—A and B were partners sharing gains and losses, A $\frac{2}{3}$, B $\frac{1}{3}$. A invested \$2700, B \$1500. At the time of settlement the assets and liabilities were as follows: Cash in hand and in bank, \$1935.42; merchandise, per inventory, \$7551.36; notes on hand per Bill Book, \$2000; various persons owed them \$966.24. They owed on their notes \$2931.95, and on personal accounts \$3978.12. What was the net capital of each partner?

PARTNERSHIP.

ASSETS.

Cash	\$1935 42
Mdse.....	7551 36
Bills Rec.....	2000 00
Personal Accts, Dr.	966 24
Total assets	<u>\$12453 02</u>

LIABILITIES.

Bills payable	\$2931 95
Personal accts, Cr.....	3978 12
Total liabilities.....	<u>\$6910 07</u>
Net capital of the firm	<u>\$5542 95</u>
A invested	\$2700 00
B do.	1500 00
Firm's net gain	<u>\$1342 95</u>
B's share of net gain ($\frac{1}{2}$).....	\$447 65
A's " " ($\frac{1}{2}$).....	895 30
A's investment.....	<u>\$2700 00</u>
His share of net gain.....	895 30
A's net capital.....	<u>\$3595 30</u>
B's investment.....	<u>\$1500 00</u>
His share of net gain.....	447 65
B's net capital.....	<u>1947 65</u>
Total net capital as above.....	<u>\$5542 95</u>

If the books had been kept by double entry the same result would be arrived at from the following data and process:

A and B were partners, sharing gains and losses A $\frac{2}{3}$, B $\frac{1}{3}$; A invested \$2700, B \$1500. At the time of settlement the Ledger showed gain on merchandise \$2151.33, and by commissions \$243.72. Loss by expense \$810, and by interest \$242.10. What was the net capital of each partner?

EXERCISES.

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GAINS.

From merchandise	\$2151 33	
" commissions	243 72	
Total gains		2395 05

LOSSES.

By expenses	\$810 00	
" interest	242 10	
Total losses		1052 10
Firm's net gain		\$1342 95
B's share of net gain ($\frac{1}{3}$)	\$447 65	
A's " " ($\frac{2}{3}$)	895 30	1342 95
A's investment	\$2700 00	
His share of net gain	895 30	
A's net capital		\$3595 30
B's investment	\$1500 00	
His share of net gain	447 65	
B's net capital		1947 65
Total net capital		\$5542 95

The Profit and Loss, and partners' accounts are shown in the following skeleton ledger accounts :

PROFIT AND LOSS.

Expense	810 00	Mdse	2151 33
Interest	242 10	Commissions	243 72
A's net gain ($\frac{2}{3}$)	895 30		
B's " " ($\frac{1}{3}$)	447 65		
	2395 05		2395 05

A.

Balance	3595 30	Investment	2700 00
		Net Gain	895 30
	3595 30		3595 30

B.

Balance	1947 65	Investment	1500 00
		Net Gain	447 65
	1947 65		1947 65

EXERCISES.

- ✓ 1. W. Smith and R. Evans were partners in business, and invested on commencing \$1000 each. On dissolving the partnership the assets and liabilities were as follows: Merchandise valued at \$1295; cash \$344; notes against sundry individuals \$790; personal accts. Dr. \$286.75. They owe a note for \$212.40, and personal accts. to the amount of \$70.75. What was each partner's interest at closing, the profits being divided equally?
- ✓ 2. John Smith and Geo. Brown started business as partners May 1st, 1882. Smith invested \$1200 and Brown \$1000. The gains and losses were to be shared equally, but Smith was to be allowed interest at 6% on his extra \$200 of capital. On December 31 a settlement being desired their resources were found to be merchandise in store \$2100; cash \$526.30; outstanding debts, considered good, \$3000. Liabilities \$2500. Smith has drawn out \$940 and Brown \$875. What was each partner's net capital?
- ✓ 3. Harvey Miller and James Manning are partners in a dry goods business. Miller invested \$1400, and Manning \$1250. The agreement is that each partner is to be allowed interest @ 7% on his investment, and that the net profits or losses are to be shared equally. At the close of one year their assets and liabilities are as follows: cash in hand \$1125.30; merchandise \$1855.75; on deposit in the Merchants' Bank \$1200; stock of the Nova Scotia Cotton Co. \$900; a building lot \$1600; bills receivable \$99.43; personal accts. Dr. \$351.72. They owe on personal accts. \$1457.33, and on notes \$1326.14. What is each partner's net capital?
- ✓ 4. J. A. Davis, John Young and Frank Russell were partners in business. Davis was to have $\frac{1}{3}$ the net gain or bear $\frac{1}{3}$ the net loss, Young and Russell each $\frac{1}{3}$. On dissolving they had cash in hand \$712.90; mdse. per inventory \$4360; bills receivable, per B. B., \$1450.75; cash on deposit in People's Bank \$3475; goods shipped to Montreal to be sold on their account and risk, valued at \$995; debts due them on book accounts \$2600, on which there was accrued interest \$44.67. They owed on notes \$3760, and to C. M. Brown & Co., Montreal, \$1312.60. J. A. Davis invested \$5750, and drew out \$875; John Young invested \$2500, and

drew out \$500 ; Frank Russell invested \$3000, and drew out \$750. What was the net capital of each partner at closing ?

5. A, B and C were partners, sharing the gains and losses equally. A's net investment was \$8752.13 ; B's \$8600 ; C's \$8500. During the year the firms gains were, on merchandise \$8529 ; on stocks and bonds \$650 ; on interest \$985.25. The cost of conducting the business was \$2125. What was each partner's interest at closing ?

6. M and N are partners, M sharing $\frac{2}{3}$ of the gain or loss, and N $\frac{1}{3}$. M invested \$15,000 and N \$5000. At the end of a year the resources and liabilities of the concern are as follows : Cash in hand, \$2128 ; bills payable, \$4000 ; bills receivable, \$3000 ; the firm owes sundry persons \$8375 ; there is due the firm from sundry persons \$16427 ; out of which \$1314.16 is written off as bad ; rent paid in advance, \$375 ; mortgage held by the concern on the property of W. S. Hope, \$5000 ; accrued interest on the same, \$150 ; shop furniture valued at \$835 ; mdee. in store \$9500 ; accrued interest on firm's notes outstanding \$112. Accrued interest on notes held by the firm \$175. M has drawn out \$2465, and N \$2075. According to agreement each partner is to receive a salary of \$2500. What are the separate interests at the close of the business ?

7. A, B and C are partners sharing gains and losses as follows : A, $\frac{1}{3}$; B, $\frac{1}{3}$; C, $\frac{1}{3}$. A invested \$3000, and has withdrawn \$2500 ; B invested \$2700, and has withdrawn \$1150 ; C invested \$2500, and has withdrawn \$430. After doing business 14 months C retires. Their assets consist of bills receivable \$2937.20 ; merchandise \$1970 ; cash \$1240.80 ; 125 shares of the People's Bank stock, par value \$20 per share ; cash deposited in the Bank of B. N. A. \$1850 ; store and furniture \$3130 ; amount due from W. Smith \$360.80 ; from G. S. Brown \$246.40 ; from E. R. Thomas \$97.12. Their liabilities are, due Saml. Harris \$1675 ; W. T. Esson \$935 ; outstanding notes \$3385.76. The People's Bank stock is valued at 10 % premium, and C on retiring takes it as part payment. What is the balance due C, and what is A's and what is B's interest in the business ?

8. M and N have been partners sharing gains and losses, M $\frac{2}{3}$, N $\frac{1}{3}$. M invested \$4500, average date March 25, 1883 ; and

drew out \$2700, average date Sept. 12, 1883. N invested \$7200, average date June 17, 1883; and drew out \$3750, average date October 25, 1883. At the time of their dissolution, December 31, 1883, the debts of the firm were all paid, and they had \$8750 cash to divide among them. What was each partner's share, allowing interest at 6 % on investments, and charging at the same rate on amounts drawn?

9. John Wood and D. C. Hunter were partners, Wood having $\frac{2}{3}$ and Hunter $\frac{1}{3}$ interest. Wood advanced at various times \$15000, average date being Feb'y. 9, 1883; and drew out \$2150, average date Nov. 1, 1883. Hunter advanced \$8000, average date March 28, 1883; and drew out \$2500, average date Nov. 20, 1883. Jan. 1, 1884, Wood purchased Hunter's interest in the business allowing him \$500 beyond the net balance to his credit for his good will. The assets were as follows: Cash \$6200; merchandise \$7180; notes on hand \$7000; accrued interest on the same \$378.14; personal accts. \$5612.40; accrued interest on the same \$242.20. The liabilities were as follows: Notes outstanding \$3810; accrued interest on the same \$210.18; personal accounts \$1875; accrued interest on the same \$83.40. For the purpose of settlement 5 % discount was allowed on the personal accounts debtor. How much was Hunter entitled to, interest being reckoned on the partners' accounts at 6 %?

Three persons A, B and C enter into a speculation, A advancing \$500, B \$550 and C \$600. They gain \$412.50, which is to be divided in proportion to the sums advanced. What is the share of each?

SOLUTION.

1650	:	500	:	:	\$412.50	:	\$125.
1650	:	550	:	:	\$412.50	:	\$137.50.
1650	:	600	:	:	\$412.50	:	\$150.

The total investment, \$1650, is to each partner's investment as the total gain, \$412.50, to each partner's share of the gain.

10. A, B, C and D purchase an oil well. A pays for 6 shares, B for 5, C for 7 and D for 8. Their net profits at the end of 3 months amounted to \$7800. What sum ought each to receive?

11. A captain, mate and 12 sailors won a prize of \$2240, of which the captain took 14 shares, the mate 6, and the remainder was equally divided among the sailors. How much did each receive?

12. A, B, C and D made a purchase of lumber for \$4000, of which A paid \$1000, B \$800, C \$1300, and D the balance. The lumber was sold for \$5700, and B was to have \$100 for attending to the purchase and sale. What was each partner's share of the profits?

13. Six persons, A, B, C, D, E and F, having gained \$7000, it is required to divide the money among them in the following proportions: A to have $\frac{1}{2}$; B $\frac{1}{3}$; C $\frac{1}{4}$ as much as A and B, and the remainder to be divided among D, E and F, in the proportion of 2, $2\frac{1}{2}$ and $3\frac{1}{2}$. How much does each receive?

14. L, M and N are conducting a business in which M's interest is $1\frac{1}{2}$ times as much as L's, and N's $1\frac{1}{2}$ times as much as L's. Having made a profit of 25 % on a capital of \$30000, it is required to find each man's share of the profits.

15. A, B, C and D trade in company, having a joint capital of \$3000. On dividing the profits in proportion to each man's capital A received \$120; B \$255; C \$225, and D \$300. What was each partner's capital?

16. Three laboring men, A, B and C, join together to reap a field of wheat for which they are to receive \$19.84. It is reckoned that A and B will do $\frac{2}{3}$ of the work; A and C $\frac{3}{4}$, and B and C $\frac{5}{6}$ of it. How much should each receive according to these estimates?

17. A, B and C together have purchased a lot of land 240 feet front and 120 feet deep. A has paid \$3000, B \$4000, C \$5000, and they agree to divide the land in proportion to what they have severally paid. How many feet front will each have?

Two merchants, A and B, enter into partnership. A invests \$700 for 15 months, and B \$800 for 12 months; they gain \$603. What is each man's share of the profits?

SOLUTION.

$$\$700 \times 15 = \$10500$$

$$\$800 \times 12 = 9600$$

$$20100 : 10500 :: \$603 : \$315, \text{ A's gain.}$$

$$20100 : 9600 :: \$603 : \$288, \text{ B's gain.}$$

The investment of \$700 for 15 months is the same as the investment of \$10500 for 1 month; and that of \$800 for 12 months is the same as \$9600 for 1 month. The investments were therefore the same as if A's had been \$10500, and B's \$9600 for 1 month, or the same length of time each. Hence the proportion as above.

18. A, B and C are associated in trade. A furnished \$300 for 6 months; B \$350 for 7 months, and C \$400 for 8 months. They have \$1490 profits to divide. What is the share of each?

19. A, B and C contract to perform a certain piece of work. A employs 40 men for $4\frac{1}{2}$ months; B 45 men for $3\frac{1}{2}$ months, and C 50 men for $2\frac{1}{4}$ months. Their profits after paying all expenses are \$850. How much of this belongs to each?

20. Four men, A, B, C and D, hire a pasture for \$27.80; A puts in 18 sheep for 4 months; B 24 for 3 months; C 22 for 2 months; and D 30 for 3 months; how much ought each to pay?

21. On the first day of January A began business with a capital of \$760, and on the first of February following he took in B, who invested \$540; and on the first of June following they took in C, who put into the business \$800. At the end of the year they found they had gained \$872. How much of this was each man entitled to?

22. Three merchants, A, B and C, entered into partnership with a joint capital of \$5875, A investing his stock for 6 months, B his for 8 months, and C his 10 months; of the profits each partner took an equal share; how much of the capital did each invest?

Three persons, A, B and C, do business for 1 year from Jan. 1, and the profits are to be shared in proportion to average investment. A, on starting, invests \$4000; April 1, withdraws \$500; Sept. 1, invests \$700. B, on starting, invests \$3000; April 1, withdraws \$600; Sept. 1, invests \$400. C, on starting, invests \$2500; June 1, \$800 more. At the end of the year they have \$1500 to divide. What is each partner's share?

SOLUTION.

A	$4000 \times 3 = 12000$	
	$- 500$	
	$\hline 3500 \times 5 = 17500$	
	$+ 700$	
	$\hline 4200 \times 4 = 16800$	46300
	$\hline$	
B	$3000 \times 3 = 9000$	
	$- 600$	
	$\hline 2400 \times 5 = 12000$	
	$+ 400$	
	$\hline 2800 \times 4 = 11200$	32200
	$\hline$	
C	$2500 \times 5 = 12500$	
	$+ 800$	
	$\hline 3300 \times 7 = 23100$	35600
	$\hline$	114100

Then,

114100	:	46300	::	\$1500	:	\$608.68 A.
114100	:	32200	::	\$1500	:	\$423.31 B.
114100	:	35600	::	\$1500	:	\$468.01 C.

A's investment was equal to \$46300 for 1 month, or an average investment for the year of \$3858 $\frac{1}{3}$. B's was equal to \$32200 for 1 month, or an average for the year of \$2683 $\frac{1}{3}$. C's was equal to \$35600 for 1 month, or an average for the year of \$2966 $\frac{2}{3}$. And the whole investment was equal to \$114100 for 1 month, or an average for the year of \$9508 $\frac{1}{3}$. The proportion may then be made thus,

$$9508\frac{1}{3} : 3858\frac{1}{3} :: \$1500 : \$608.68 \text{ A,}$$

and so on for the others. But it is clear that 12 times the first and second terms bear the same ratio to one another as the terms themselves, and by taking the average for 1 month instead of for the year fractions are avoided. The first proportion above is therefore to be preferred.

23. Two merchants, A and B, entered into partnership for two years; A at first furnished \$800, and at the end of one year \$500 more; B furnished at first \$1000, at the end of 6 months \$500 more; and after they had been in business one year he was compelled to withdraw \$600. At the expiration of the partnership their net profits were \$2550. How much must A pay B who wishes to retire from the business?

24. A, B and C are partners. A puts in to the concern \$4000, but withdraws half of it at the end of 6 months; B puts in \$2500, and adds \$500 at the end of 4 months; C puts in \$2800, and at the end of 8 months adds \$400. The gain during the year is \$1800. What is each one's share?

25. A, B and C are in partnership from the 1st of January under the following conditions: A is to manage the business at a salary of \$1800 which is to be credited on July 1. He is to receive interest on his salary from the date of credit, and pay interest on sums withdrawn by him @ 6 %. B and C furnish the capital, and are to receive interest therefor at the rate of 6 %. The net gain or loss to be divided equally. B invests, Jan. 1, \$10000, May 1, \$5000. C invests, Jan. 1, \$10000, July 1, \$5000. A draws out Feb'y. 1, \$250; March 10, \$200; June 15, \$500; Sept. 25, \$300; Nov. 21, \$100. At the end of the year the gain, before the interest on the partners' accounts is reckoned, is \$6384.80. What will be the balance of each partner's acct. when everything is properly entered?

NOTE.—In reckoning interest when the time is even months reckon by months; when not, reckon by days.

26. Three sportsmen go out for a day's fishing. A takes 3 rolls for lunch, B 5, and C takes none. Meeting when all are hungry they take their meal together, A and B charging C 24 cents for his meal. On the assumption that the food is divided equally, how should A and B divide the 24 cents between them?

27. A and B buy a ship for \$40000, A having $\frac{2}{3}$ interest and B $\frac{1}{3}$. Subsequently they sell C a $\frac{1}{3}$ interest for \$18000, and agree to retain each $\frac{1}{3}$ interest. How much of the \$18000 belongs to A, and how much to B?

28. J, K and L are partners, J to have $\frac{1}{3}$ of the gain or loss, K $\frac{1}{3}$ and L $\frac{1}{3}$. Interest is to be reckoned at 7 % on the partners' accounts, and each partner is to receive a salary of \$1800 to be credited on July 1. J invested, Jan. 1, \$16000, and withdrew during the year \$4875, average date Aug. 18. K invested, Jan. 1, \$21000, and withdrew \$7224, average date July 10. L invested, Jan. 1, \$6000, and withdrew \$2525, average date July 15. Dec. 31, the merchandise account shows a gain of \$18743.16; the interest acct. (before the interest on the partners' accts. is reckoned) a gain of \$496.12; sundry shipment accts. show a net gain of \$1572.10. The expense acct. (not counting the partners' salaries) shows a loss of \$2842.72. What is each partner's interest in the business at closing?

29. E, F, G and H are partners in business, each to have $\frac{1}{4}$ of the net gain or loss. The business is carried on for one year, when E and F purchase from G and H their interest in the business, allowing each \$100 for his good will. Upon examination their resources are found to be as follows: Cash in bank \$3645; cash in hand \$1422; bills receivable \$1685; a bond and mortgage \$2746, upon which there is interest accrued \$106; 5 shares Bank of Montreal stock \$1000 (par value); 25 shares Halifax Banking Co's. stock; merchandise \$4125; store and furniture \$3500; house and lot \$1800; span of horses, carriages, harness, &c., \$495; outstanding debts due the firm \$4780. Their liabilities are, notes payable \$6470, upon which interest has accrued \$57; due on book debts \$1560. E invested \$5000, and has drawn out \$1200, on which there is interest \$32. F invested \$4500, and has drawn out \$1000, interest \$24.50. G invested \$4000, and has drawn out \$950, interest \$12. H invested \$3000, and has drawn nothing. In the settlement 10 % discount for bad debts is allowed on book debts due the firm, and on bills receivable. G takes the Bank of Montreal stock at 190, and H takes the Halifax Banking Co's. stock at 108. How much is still due G and H, and what are E and F's net capitals, allowing all the debts to be good?

30. H. C. Wright, W. S. Samuels and E. P. Hall are doing business together—H. C. W. to have $\frac{1}{4}$ gain or loss; W. S. S. and E. P. H. each $\frac{1}{4}$. After doing business one year, W. S. S. and E. P. H. retire from the firm. On closing the books and taking stock, the following is found to be the result: Merchandise on hand \$3216.50; cash deposited in Bank of Nova Scotia \$1627.35; cash in till \$134.16; bills receivable \$940.60; G. Brown owes, on account, \$112.40; Thos. A. Bryce \$94.12; W. McKee \$143.95; J. Anderson \$54.20; R. H. Hill \$43.60, and S. Graham \$260.13. They owe on notes not redeemed \$1864; H. T. Collins, on account, \$124.45; and W. F. Curtis \$79.40. H. C. Wright invested \$3200, and has drawn from the business \$350. W. S. Samuels invested \$2455, and has drawn \$140. E. P. Hall invested \$2100, and has drawn \$2000. A discount of 10 % is to be allowed on the bills receivable and book accounts due the firm for bad debts. H. C. Wright takes the assets and assumes the liabilities. What is the settlement among the partners at dissolution?

31. I, J, K, L and M were partners sharing the gains and losses as follows: I, $\frac{1}{5}$; J, $\frac{2}{5}$; K, $\frac{1}{5}$; L, $\frac{1}{5}$; M, $\frac{1}{5}$. On dissolving, the resources consisted of, cash, \$4700; merchandise, \$9855; notes, \$7680; Halifax city debentures, \$6780; accrued interest on same, \$123; horses, waggons, &c., \$1280; Merchants Bank stock, \$5000; Union Bank stock, \$5000; bonds and mortgages, \$3600; accrued interest on same, \$345.80; store and fixtures, \$8000; personal accts. dr. \$4130.60. The liabilities are, mortgage on store, \$5000; accrued interest on same, \$212.25; due the estate of R. M. Evans, \$14675; notes and acceptances, \$11940, on which interest is due \$85; sundry book debts, \$7500. I invested \$7800, interest on same \$702; J invested \$6400, interest \$576; K invested \$6100, interest \$549; L invested \$5800, interest \$522; M invested \$5000, interest \$450. I has withdrawn at different times \$2425, upon which the interest is \$183.40; J has drawn \$2960, interest \$267.85; K has drawn \$1850, interest \$87.30; L has drawn \$3000, interest \$460; M has drawn \$895, interest \$63.45. What is the net capital of each partner?

32. A, B, C and D are partners. At the time of dissolution, and after the liabilities are all cancelled, they make a division of the effects, and upon examination of their ledger it shows the following result:—A has drawn from the business \$3465, and invested on commencement of business, \$4240; B has drawn \$4595, and invested \$3800; C has drawn \$5000, and invested \$3200; D has drawn \$2200, and invested \$2800. The profit or loss was to be divided in proportion to the original investments. What has been each partner's gain or loss, and how do the partners settle with each other?

33. Three mechanics, A. W. Smith, James Walker and P. Ranton are equal partners in their business, with the understanding that each is to be charged \$1.25 per day for lost time. At the close of their business, in the settlement it was found that A. W. Smith had lost 14 days, James Walker 21 days, and P. Ranton 30 days. How shall the partners properly adjust the matter between them?

34. There are 5 mechanics on a certain piece of work in the following proportions:—A is $\frac{1}{5}$; B, $\frac{2}{5}$; C, $\frac{1}{5}$; D, $\frac{1}{5}$, and E,

34. A is to pay \$1.25 per day for all lost time; B, \$1; C, \$1.50; D, \$1.75, and E, \$1.62½. At settlement it is found that A has lost 24; B, 19; C, 34; D, 12; and E, 45 days. They receive in payment for their joint work, \$2500. What is each partner's share of this amount according to the above regulations?

35. A. B. Smith and T. C. Wilson commenced business in partnership January 1. A. B. Smith invested, on commencement, \$9000; May 1, \$2400; June 1 he drew out \$1800; September 1, \$2000, and October 1 he invested \$800 more. T. C. Wilson invested on commencing, \$3000; March 1 he drew out \$1600; May 1, \$1200; June 1, he invested \$1500 more, and October 1, \$8000 more. At the time of settlement, on December 31, their merchandise account was—*Dr.* \$32000; *Cr.* \$29456; balance of merchandise on hand, as per inventory, \$10500; cash in hand, \$4900; bills receivable, \$12400; R. Draper owes on acct., \$2450. They owe on their notes, \$1890, and G. Roe on acct., \$840. Their Profit and Loss acct. is—*Dr.* \$866; *Cr.* \$1520. Expense acct. is—*Dr.* \$2420. Commission acct. is—*Cr.* \$2760. Interest acct. is—*Dr.* \$480; *Cr.* \$950, besides which interest is to be allowed each partner at 7 % on his investments and charged at the same rate on the amts. withdrawn. Gains and losses to be shared equally. Work out by both single and double entry methods and give each partner's net capital.

36. A owns a business the good will of which is estimated at \$10000, and the stock on hand at \$15000. B and C agree to unite with him on the following conditions: B to invest \$25000 cash, and C to devote his time to the business for which he is to receive, in addition to his interest, an annual salary of \$1000. The capital to be kept intact and no interest to be allowed therefor. The gain or loss to be shared equally among the three partners. At the end of the year the resources, including the good will, book accts., notes, inventories, etc., amount to \$66425, and the liabilities to outside parties, to \$10500. C has drawn during the year, \$2500; B, \$1575; A, \$2000. What is the balance of each partner's acct.?

37. A, B and C are partners in business, investing as follows: A, \$4000; B, \$6000; C, \$8000. The partners are to share the profits and losses in proportion to their investments. Each is

entitled to compensation for services at the rate of \$150 per month, payable at the end of each month and not to bear interest. In case that either party draw a greater amount than shall be due him for services, he shall be charged interest upon such overdraft at the rate of 1 % per month for the length of time such overdraft continues. At the end of the year B and C purchase A's interest, and in the payment therefor it is desired that the remaining partners shall so invest that their interests shall be equal. It is mutually agreed that, for the purpose of settlement, the "good will" of the business shall be valued at \$3000. It is also agreed that a discount of 5 % shall be allowed upon all uncollected accounts as a fund to meet bad debts and costs of collection. A statement of the business previous to closing shows the following results: Merchandise, horses, waggon and office-fixtures, \$9840; cash in hand, \$2570; sundry debtors, \$17030; sundry creditors, \$4050; expense acct. (not including partners' salaries) \$2400; profit on merchandise sold, \$15290. A was paid on acct. of salary, April 1, \$450; July 1, \$300; Oct. 1, \$400. B, March 1, \$400; April 1, \$150; June 1, \$400; Oct. 1, \$800; Dec. 1, \$500. C, April 1, \$600; July 1, \$700; Oct. 1, \$600; Nov. 1, \$200. How much must B and C each invest in purchasing A's interest. And how should the books of the new firm be opened?

GENERAL AVERAGE.

General Average is a method of equitably distributing among all parties concerned any loss which has been sustained by one or more of the parties by a necessary and voluntary sacrifice of property for the common safety. It is especially applied to the adjusting of such loss when happening at sea where a vessel and contents are saved from destruction by the voluntary sacrifice of a part of her cargo, or by cutting away her masts, rigging, &c.

Among the losses which become subjects of general average are the following :

1. Jettison, or the casting overboard of cargo, stores, &c., for the purpose of lightening the ship ; damage to cargo by the influx of water during jettison ; freight of goods jettisoned.
2. Two-thirds the cost of replacing masts, sails, &c., voluntarily sacrificed to save the ship.

NOTE.—When a vessel is on her first voyage the whole cost of such repairs is allowed.

3. Damage resulting from running the ship ashore to prevent her sinking if the operation is successful in saving her.
4. Expense of entering port of refuge, cost of discharging and reloading cargo, rent of warehouses, &c., &c.
5. Wages of seamen from date of bearing up till ready for sea.

NOTE.—Some of the above charges are allowed as subjects of general average in some countries, and not in others, the practice not being entirely uniform. The above general heads, however, though capable of great subdivision into particulars, include all or nearly all allowed in any country.

The Contributory Interests on which these charges are assessed are, in general terms, the ship, cargo and freight.

The ship contributes on its full value at the time the loss occurred.

The cargo (including the portion sacrificed, if any) contributes on its market value at the port of destination less freight and charges.

The freight contributes on the full amount earned, less the captain's and crew's wages for the voyage and all incidental expenses.

NOTE.—In some places $\frac{1}{2}$, and in others $\frac{1}{3}$ is deducted from the freight for seamen's wages, but generally the exact amount is ascertained and deducted.

An **Average Adjuster** is one whose business it is to adjust and apportion the losses and expenses of general averages.

EXAMPLE.—The steamer *Cuba* left Halifax for Liverpool with a cargo as follows: Shipped by A, \$7480; by B, \$5365; by C, \$9218; by D, \$11428; by E, \$7559. After two days out a heavy gale was experienced, and it became necessary for the general safety to throw overboard a part of the cargo, and to put into St. John's for repairs. Repairs were made to the steamer costing \$1176. The total cost of entering the port of refuge, including wages, port charges, dockage, &c., was \$1498. The value of cargo jettisoned was estimated at \$4282, of which \$1123.40 belonged to B, and the remainder to E. The steamer was valued at \$100000, and the freight, less seamen's wages, was \$3450. What was the loss per cent., and the settlement among the parties interested?

SOLUTION.

LOSS FOR GENERAL AVERAGE.	CONTRIBUTORY INTERESTS.
Cargo jettisoned. \$4282	Steamer.....\$100000
Expenses entering port.. 1498	Cargo 41050
Total loss \$5780	Freight 3450
	Total.....\$144500

$\$5780 \div \$144500 = .04$, or 4 %, loss per cent.

EXERCISES.

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APPORTIONMENT.

Steamer's share of loss, 4 % of \$100000	=	\$4000
Freight's " " 4 % of	3450	= 138
A's " " 4 % of	7480	= 299.20
B's " " 4 % of	5365	= 214.60
C's " " 4 % of	9218	= 368.72
D's " " 4 % of	11428	= 457.12
E's " " 4 % of	7559	= 302.36

Total loss, 4 % of \$144500 = \$5780.00

ADJUSTMENT.

\$4138 - \$2498 = \$2640 bal. payable by steamer.

\$1123.40 - \$214.60 = \$908.80 bal. payable to B.

\$3158.60 - \$302.36 = 2856.24 bal. payable to E.

PAYABLE BY		RECEIVABLE BY	
Steamer.....	\$2640	B.....	\$ 908.80
A.....	299.20	E.....	2856.24
C.....	368.72		
D.....	457.12		
	\$3765.04	=	\$3765.04

EXEROISES.

1. The bark *Ocean Queen*, on her trip from Philadelphia to Liverpool, was crippled in a storm, in consequence of which, and to save the bark from total loss, a portion of the cargo, afterwards ascertained to be worth \$4465.50, was jettisoned, and one mast, costing to replace \$595.75, was cut away. The cargo and ownership were as follows: A, \$3650; B, \$6500; C, \$2000; D, \$550; E, \$5450; F, \$8500. Of that thrown overboard there belonged to B \$3000, and to F \$1465.50. The contributory interests were, vessel \$30,000; cargo, as above, and net freight, less seamen's wages, \$4150. Required the loss per cent., and the settlement among the parties concerned.

2. The steamer *Persian* left Boston for Halifax, laden with 7210 bushels wheat, consigned to A, and invoiced at 95 cents per

bushel; 4815 bushels corn, consigned to B, and invoiced at 60 cents per bushel, and 3180 bbls. flour, consigned to C, and invoiced at \$5.50 per bbl. When near Halifax the steamer collided with the *Bay State*, and to prevent foundering the captain found it necessary to throw overboard 1600 bush. wheat, 1280 bush. corn, and 1140 bbls. flour. On estimating the proportionate loss it was allowed that the wheat would have sold in Halifax at an advance of 10 %, the corn at an advance of 15 %, and the flour at \$5 per bbl. The contributory interests were, steamer \$95000, cargo as above given, and net freight \$5246.20. What is the per cent. of loss, and the settlement?

3. The ship *Edith* left Baltimore for New Orleans, with 7000 bush. wheat, valued at \$1.25 per bush., shipped by Dunn, Lloyd & Co.; 9200 bush. corn, valued at 75 cents per bush., shipped by J. W. Roe; 14800 bush. oats, valued at 37½ cents per bush., shipped by Morris Wright & Co.; 1800 bbls. flour, valued at \$5.25 per bbl., shipped by Smith & Worth. In consequence of a violent gale in the Gulf of Mexico, it was found necessary to throw overboard the flour, 4600 bush. oats and 3150 bush. wheat; and masts and rigging were cut away, which cost to replace \$3694.17. The ship was on her first voyage, and was valued at \$45000. The freight, after deducting seamen's wages and other expenses, was \$1950. Required the loss per cent., and the settlement.

4. The ship *Menos* from Halifax to Charleston had on board the following cargo: Shipped by A, \$6500; by B, \$7500; by C, \$17400, and by D, \$9000. After the first day out she encountered heavy gales, and sustained considerable damage, so that for the safety of the vessel and cargo, stores to the value of \$660.15 were jettisoned, and the ship bore away for Yarmouth for repairs. The disbursements of the agents at Yarmouth were as follows: Custom house fees, pilotage, towage, protest, surveys, handling cargo, wharfage, &c., \$1400. Repairs to ship, \$1135.80. Agents' commission for advancing funds, 5 %. Wages and provisions of seamen from point of deviation, \$380.93. The freight, less seamen's wages and other charges, \$5624. The ship was valued at \$12000. Adjuster's fee \$100. What is the settlement among the parties interested?

MISCELLANEOUS EXERCISES FOR COMMERCIAL STUDENTS.

1. A merchant bought 500 bushels wheat, and sold one-half of it at 80 cents per bushel, which was 10 % more than it cost him, and 5 % less than his asking price. He sold the remainder at $12\frac{1}{2}$ % more than it cost him. What was the cost per bushel, what was his asking price, and how much did he gain on the whole?

2. May 1, 1880, I got my note for \$2000 payable in 6 months discounted at a bank at 6 %, and immediately invested the proceeds in woodland. Nov. 9, I sold the land at an advance of 15 %, receiving $\frac{2}{3}$ of the price in cash, which I loaned the same day at 6 % interest. For the remainder I received a note payable in 1 year, 9 months, and bearing interest at 7 % after Dec. 31, 1881. When my note at the bank became due I renewed it for 6 months, and did the same again and again, each for 6 months, and then for three months; when the last renewal became due, I collected what was due me, and paid it. How much money did I have left? The student will also write up all the entries in the Cash Book in proper form.

3. Five men were partners for 4 years in a business which required the time and attention of only one of them. The profits were to be divided in proportion to average investment. They advanced capital as follows:—A, \$60 at first, and \$800 more at the end of 5 months, and \$1500 at the end of a year and 8 months. B, \$600 at first, and \$1800 at the end of 6 months. C, \$400 at first, and \$500 every 6 months thereafter. D, \$900 at the end of 8 months, and the same sum every 6 months thereafter. E paid in no money, but managed the business and kept the books, for which he was to receive a salary of \$600 per annum, to be credited as an investment at the end of each year. The net profits at the end

of 4 years were \$20000. What was the net interest of each partner? Give the Journal Entry with the figures to close the Profit & Loss acct.

4. Smith, in Montreal, and Jones, in Toronto, have been working in partnership, Jones buying and shipping to Smith, who sells the goods in Montreal, the profits to be equally divided. Smith remitted Jones a draft for \$8000 after Jones had made purchases to the amount of \$13682.24. Jones has sent to Smith merchandize of which the latter has made sales to the value of \$9241.18. Jones has also made sales to the value of \$2826.34. Smith has paid \$364.16 and Jones \$239.14 for expenses. At the end of the year Jones has on hand goods worth \$2327.34, and Smith goods worth \$3123.42. The period for which the agreement was made having now expired, it is required to know what the net gain has been, and what money must pass between the partners to settle,—each being willing to keep the goods in his possession at the above valuations.

5. The select men of a certain town appointed a liquor agent, and furnished him with liquor to the amount of \$825.60, and cash, \$215. The agent received cash for liquor sold, \$1323.40. He paid for liquor bought, \$937; to the town treasurer, \$300; sundry expenses, \$29; his own salary, \$265; he delivered to indigent persons, by order of the town, liquor to the amount of \$13.50. Upon taking stock at the end of the year, the liquor on hand amounted to \$616.50. Did the town gain or lose by the agency, and how much; has the agent any money in his hands belonging to the town; or does the town owe the agent, and how much in either case?

6. A holds B's note for \$575, payable at the end of 4 months from July 13; on August 9, A received \$62 in advance, as part payment, and on September 5, \$45 more; and on October 3, B wishes to tender such a sum as will, together with the payments already made, extend the time of payment forty days forward; how much must he tender?

7. My agent at Mobile buys for me 500 bales of cotton, averaging 500 lbs. per bale, at 10 cents per pound. I allow him $1\frac{1}{2}$ per cent. on the amount paid for the cotton, and shipping charges at 60 cents per bale, and accept his draft at 60 days from

January 1 for an amount sufficient to pay for the cotton, charges and commission, including also 2 per cent. discount on the draft. On receipt of the invoice, I insure for the amount of the draft plus 10 per cent.; I pay $1\frac{1}{4}$ per cent. premium on the amount insured, and from the premium is discounted $1\frac{1}{2}$ per cent. for cash. On arrival of the cotton I pay $\frac{1}{4}$ of a cent per pound for freight, and 5 per cent. primage to the captain on the freight money, and also 4 cents per bale for wharfage. I sell it on the wharf, January 20, at \$1 per bale profit, and agree to take in payment the note of the purchaser for 6 months from January 20. What amount would be received on the note when discounted at a bank on the same day at 7 per cent?

8. I have purchased for cash, per the order of J. P. Fowler, 70 boxes of bacon, containing on an average 400 lbs. each, @ $13\frac{3}{4}$ cents per lb., and 140 firkins butter, in all 8312 lbs. @ $17\frac{1}{2}$ cents per lb., on commission @ $2\frac{1}{2}$ %, and paid shipping and other expenses in cash \$13.40. I wish to draw on J. P. Fowler at sight in full settlement of my account, and I shall have to sell the draft at $\frac{1}{2}$ % discount. Required the face of the draft, and all the journal entries.

9. J. A. Jones, of Halifax, owes W. A. Murray & Co., of Washington, \$1742.75, being net proceeds of a consignment of tobacco sold for them, and Simpson & Co., of Washington, at the same time owe J. A. Jones' \$2000 payable in Washington. J. A. Jones is to remit W. A. Murray & Co. the proceeds of their consignment, and he does so by a draft on Simpson & Co. Now if drafts on Washington are at 2 % premium, what would be J. A. Jones's journal entry on making the remittance? Also what would be his journal entry if similar exchange were at 2 % discount?

10. A. Cummings, of London, England, owes me a certain sum payable there, and I owe Chas. Massey, of the same place, \$1985.42, being proceeds of a consignment of broadcloth sold for him here. I remit Chas. Massey, by his order, in full of acct., together with \$21.12 interest, my bill of exchange at 60 days sight, on A. Cummings. Give my journal entry, the buying price of sterling exchange being $109\frac{3}{4}$?

11. On May 1, I purchased for cash 380 bbls. mess pork @ \$27.50 per bbl. on commission @ $2\frac{1}{2}$ %, and shipped Ross, Winans & Co., commission merchants, Baltimore, by arrangement, to be sold

on joint account of them and myself, each one half. Paid shipping expenses \$7.40. July 7, I received from Ross, Winans & Co., an acct. sales, showing half the net proceeds to be \$5319.79 due as per average, Aug 12, and they advise me to draw on them payable at that date in full of acct., including interest @ 7 %. What should be the face of the draft if it cost $\frac{1}{4}$ % to cash it, and what journal entries should be made for the whole business?

12. On Sept. 27, I received from James Watson, Leeds, Eng., a consignment of 1243 yds. black broadcloth, invoiced at 13/6 per yard, to be sold on joint acct. of consignor and myself, each one half, my half to be as cash, — invoice dated Sept. 16. Oct. 5, I sold R. Duncan for cash 207 yds. @ \$3.75; Oct. 24, Jas. Grant on 3 months' credit, 317 yds. @ \$3.90; Nov. 18, E. G. Congdon, on his note at 4 months, 400 yds @ \$3.95; Dec. 12, J. A. Davis for half cash, and acct. at 1 month for balance, the remainder at \$3.85. Charge for storage, advertising, &c., \$13.40, and commission and guarantee 5 %. When were the net proceeds due as cash; what was the average time of Jas. Watson's acct., and what would be the face of a sterling bill, dated Dec. 15, at 60 days after date, remitted Jas. Watson to balance acct. purchased at 108 $\frac{1}{2}$, interest being allowed at 7 %? Also give journal entries for the business transacted.

13. March 19, I shipped per steamer Caspian and consigned to Samuel Vestry, Liverpool, Eng., to be sold on joint acct. of consignee and consignor, each one half, (consignee's half to be on 4 months), 27,894 lbs. cheese, worth 11 cts. per pound. Paid shipping expenses \$18.30, and insurance on above valuation plus 10 % @ 1 $\frac{1}{4}$ %. May 19, I received from Samuel Vestry an acct. sales showing half net proceeds to be £298 14s. 10d., due as per average, Aug 21. May 28, I drew on Samuel Vestry, at the number of days after date that it took to make the bill fall due at the properly equated time of his acct., and sold the bill at 109 $\frac{1}{4}$. Required the number of days I drew the bill at, its face, and the journal entries.

14. J. H. Smith, S. North and E. Wills, commenced business together as partners under the name and style of J. H. Smith & Co., on January 1st, 1882, with the following effects: merchandise, \$7844; cash, \$5000; store and furniture, \$3984; bills receivable, \$1732.50; of this amount there belonged to J. H. Smith, as

capital, \$8000; S. North, \$6000; E. Wills, \$4560.50. The firm assumed the liability of E. Wills, which was a note for \$425.80; This note was paid on March 10th. The loss or gain was to be shared equally by the partners, but interest at the rate of 7 per cent. per annum was to be allowed on investments, and charged on amounts withdrawn. J. H. Smith was to manage the business on a salary of \$1000 a year, payable half-yearly (the time of the other partners not being required in the business). March 14, S. North drew cash, \$300; E. Wills, \$200; April 19, J. H. Smith drew \$500; S. North, \$100. On May 1, they admitted Geo. Smith as a partner, under the original agreement, with a cash capital of \$4000. The books not being closed, he paid each partner for a participation in the profits to this time \$450, which they invested in the business. May 14, J. H. Smith drew \$160; May 24, E. Wills, \$100; June 12, S. North, \$250, and J. H. Smith, \$200; July 1, E. Wills \$300, and S. North, \$450; July 21, E. Wills \$180. July 31, E. Wills retired from the partnership, the firm allowing him \$500 for his profits and goodwill in the business, which amount, together with his capital, was paid in cash. Oct. 14, George Smith drew, \$340; J. H. Smith, \$725. November 1, with the consent of the firm, S. North disposed of his right, title, and interest in the business to J. K. White, who was admitted a partner under the original agreement. J. K. White allowed S. North \$600 for his share of the profits to date, and his good-will in the business. J. K. White not receiving funds anticipated, was unable to pay S. North but \$1500, the firm therefore assumed the balance as a liability. December 10, received from J. K. White, and paid over to S. North, the full amount due him (S. N) to date. December 31, the books were closed, and the following effects were on hand:—Mdse, \$11943.75; cash, \$2110.12; bills receivable, \$6400; store and furniture, \$3850; personal accounts Dr. \$14987.50; personal accounts Cr. \$10711; bills payable unredeemed, \$4000. What has been the net gain or loss, the net capital of each partner at the end of the year, and what were the double entry journal entries on commencing business, when Geo. Smith was admitted, when E. Wills retired, when S. North sold his interest and right to J. K. White, for J. H. Smith's salary, and the interest due from, and to, each partner, and the balance sheet at the end of the year?

ANSWERS.

PRELIMINARY EXERCISES, PAGES 1 to 4.

- | | | | |
|-------------|---------------------------|-------------------------|-----------------------|
| 1. \$2308. | 15. 162. | 29. 156. | 43. \$19.50; \$526.50 |
| 2. \$1335. | 16. 1008. | 30. 95 cts. | 44. \$5.25. |
| 3. 525. | 17. 245. | 31. 189. | 45. \$4.88. |
| 4. \$1116. | 18. 37375. | 32. \$537. | 46. \$437.50; |
| 5. 1758. | 19. 39262. | 33. 144. | \$2625; |
| 6. \$123.06 | 20. 56940. | 34. 147 $\frac{1}{4}$. | \$136500. |
| 7. \$2332. | 21. 21000 lbs. | 35. 17079. | 47. 1230. |
| 8. 102206. | 22. \$435. | 36. 35 cts. | 48. \$845. |
| 9. \$3961. | 23. 5123. | 37. \$892.50. | 49. \$1039350. |
| 10. \$2057. | 24. 4893. | 38. 720. | 50. \$2075.75. |
| 11. 2943. | 25. 256198. | 39. 35. | 51. 1440. |
| 12. \$142. | 26. 84239 $\frac{1}{2}$. | 40. 128. | 52. 22 miles. |
| 13. 285594. | 27. 24404 $\frac{1}{2}$. | 41. 16 cts. | 53. \$537.75. |
| 14. 1875. | 28. \$4. | 42. \$22.05. | 54. 32 cts. |
| | 55. 300000 lbs. | 56. \$5.75. | |

PRIME FACTORS, PAGE 10.

- | | |
|---------------------|------------------------------------|
| 1. 5, 7 | 7. 2, 3, 5, 7 |
| 2. 3, 5, 5 | 8. 2, 3, 5, 7, 11 |
| 3. 3, 7, 31 | 9. 2, 2, 2, 2, 2, 2, 3, 3, 3, 5, 7 |
| 4. 2, 2, 3, 3, 7, 7 | 10. 2, 3, 7, 11, 17, 23 |
| 5. 2, 3, 3, 11 | 11. 3, 7, 11, 13, 17 |
| 6. 3, 3, 19 | |

GREATEST COMMON DIVISOR, PAGES 11, 12.

- 1—8. 2—18. 3—42. 4—35.
 1—13. 2—54. 3—234. 4—33. 5—4. 6—96. 7—16. 8—6

LEAST COMMON MULTIPLE, PAGE 13.

- | | | |
|--------|---------|---------|
| 1. 720 | 4. 198 | 7. 128 |
| 2. 420 | 5. 2520 | 8. 729 |
| 3. 336 | 6. 528 | 9. 2310 |

FRACTIONS.

REDUCTION OF FRACTIONS.

Case I, page 15.

1. $\frac{3}{4}$	6. $\frac{2}{3}$	11. $\frac{1}{2}$	16. $\frac{1}{7}$
2. $\frac{2}{3}$	7. $\frac{1}{11}$	12. $\frac{1}{13}$	17. $\frac{1}{10}$
3. $\frac{4}{9}$	8. $\frac{1}{5}$	13. $\frac{1}{2}$	18. $\frac{1}{10}$
4. $\frac{1}{2}$	9. $\frac{2}{3}$	14. $\frac{1}{8}$	19. $\frac{1}{12}$
5. $\frac{7}{18}$	10. $\frac{2}{35}$	15. $\frac{1}{4}$	20. $\frac{1}{15}$

Case II, page 16.

1. 49.	4. $9\frac{1}{2}$	7. $83\frac{1}{2}$	10. $30\frac{1}{2}$
2. 71	5. $19\frac{1}{2}$	8. $17\frac{1}{2}$	11. $5\frac{1}{2}$
3. $4\frac{1}{2}$	6. $7\frac{1}{2}$	9. $5\frac{1}{2}$	12. $38\frac{1}{2}$

Case III, page 17.

1. $\frac{1}{2}$	4. $\frac{1}{2}$	7. 53	10. $\frac{2}{3}$
2. $\frac{1}{2}$	5. 68	8. $\frac{1}{2}$	11. $\frac{1}{2}$
3. $\frac{1}{2}$	6. 61	9. $\frac{1}{2}$	

MULTIPLICATION OF FRACTIONS.

Case I, page 17.

1. $1\frac{1}{2}$	4. $3\frac{1}{2}$	7. $2\frac{1}{2}$
2. $6\frac{1}{2}$	5. $1\frac{1}{2}$	8. $5\frac{1}{2}$
3. $3\frac{1}{2}$	6. $10\frac{1}{2}$	9. $3\frac{1}{2}$

Case II, page 18.

1. $2\frac{1}{2}$	4. $1\frac{1}{2}$	7. 351
2. $6\frac{1}{2}$	5. $1992\frac{1}{2}$	8. $2697\frac{1}{2}$
3. $12\frac{1}{2}$	6. 9	9. $71\frac{1}{2}$

Case III, pages 18, to 20.

1. $\frac{1}{2}$	5. $\frac{1}{2}$	9. $\frac{1}{2}$	13. $1\frac{1}{2}$
2. $\frac{1}{2}$	6. $4\frac{1}{2}$	10. $\frac{1}{2}$	14. $8\frac{1}{2}$
3. $\frac{1}{2}$	7. 24	11. $\frac{1}{2}$	15. $\frac{1}{2}$
4. $\frac{1}{2}$	8. $3\frac{1}{2}$	12. $\frac{1}{2}$	16. 1
			17. $2\frac{1}{2}$

Case IV, pages 20, 21.

- | | | | |
|------------------------|-------------------------|-------------------------|------------------------------|
| 1. 24688 | 6. 133008 $\frac{3}{4}$ | 11. 53550. | 16. \$66 |
| 2. 1216 $\frac{2}{7}$ | 7. 39804 $\frac{3}{8}$ | 12. 60391 $\frac{1}{2}$ | 17. \$81.81 $\frac{1}{2}$ |
| 3. 33936 $\frac{3}{4}$ | 8. 80888 $\frac{1}{2}$ | 13. 55979 $\frac{1}{4}$ | 18. \$11635.31 $\frac{3}{4}$ |
| 4. 16406 $\frac{1}{4}$ | 9. 50109 $\frac{1}{6}$ | 14. 48803 $\frac{3}{8}$ | 19. \$7.97 $\frac{3}{8}$ |
| 5. 60606 $\frac{2}{3}$ | 10. 15725 $\frac{2}{3}$ | 15. 29850 | 20. 20261 $\frac{1}{2}$; |
- 25643 $\frac{1}{4}$; 36470 $\frac{3}{8}$; 59095 $\frac{5}{8}$

DIVISION OF FRACTIONS.

Case I, page 22.

- | | | | |
|---------------------|-------------------|----------------------|----------------------|
| 1. $\frac{1}{6}$ | 5. $\frac{3}{47}$ | 9. $\frac{15}{286}$ | 13. $\frac{3}{8}$ |
| 2. $\frac{1}{7}$ | 6. $\frac{5}{48}$ | 10. $\frac{13}{126}$ | 14. $\frac{18}{285}$ |
| 3. $\frac{3}{8}$ | 7. $\frac{4}{27}$ | 11. $\frac{2}{22}$ | 15. $3\frac{7}{20}$ |
| 4. $\frac{19}{235}$ | 8. $\frac{1}{7}$ | 12. $\frac{5}{47}$ | |

Case II, page 22.

- | | | | |
|-------------------|---------------------|----------------------|-----------------------|
| 1. $1\frac{1}{2}$ | 4. 39 | 7. 84. | 10. 550 $\frac{3}{4}$ |
| 2. 20 | 5. 37 $\frac{1}{2}$ | 8. 211 $\frac{1}{2}$ | 11. 264 $\frac{3}{4}$ |
| 3. 21 | 6. 63 | 9. 198 | 12. 145 $\frac{1}{2}$ |

Case III, pages 23, 24.

- | | | | |
|--------------------|---------------------|---------------------|----------------------|
| 1. $\frac{29}{32}$ | 10. $\frac{2}{17}$ | 19. $\frac{3}{22}$ | 28. $11\frac{1}{2}$ |
| 2. $1\frac{1}{14}$ | 11. $2\frac{1}{2}$ | 20. $\frac{27}{26}$ | 29. $3\frac{3}{7}$ |
| 3. $\frac{11}{12}$ | 12. $2\frac{1}{4}$ | 21. $\frac{3}{8}$ | 30. $2\frac{1}{3}$ |
| 4. $\frac{4}{23}$ | 13. $1\frac{3}{4}$ | 22. $1\frac{3}{8}$ | 31. $\frac{7}{32}$ |
| 5. $5\frac{1}{4}$ | 14. $1\frac{1}{3}$ | 23. $1\frac{2}{7}$ | 32. $8\frac{1}{2}$ |
| 6. $13\frac{1}{2}$ | 15. $2\frac{1}{4}$ | 24. $\frac{5}{8}$ | 33. $\frac{3}{8}$ |
| 7. $\frac{29}{32}$ | 16. $11\frac{1}{8}$ | 25. $1\frac{2}{33}$ | 34. 18 |
| 8. $\frac{5}{11}$ | 17. $1\frac{1}{8}$ | 26. $1\frac{2}{13}$ | 35. $\frac{22}{29}$ |
| 9. $1\frac{3}{4}$ | 18. $7\frac{1}{2}$ | 27. $\frac{2}{3}$ | 36. $\frac{64}{243}$ |

Case IV, page 25.

- | | |
|--------------------------|-------------------------|
| 1. 1583 $\frac{7}{8}$ | 6. 109 $\frac{47}{256}$ |
| 2. 546 $\frac{1}{4}$ | 7. 46 $\frac{1}{15}$ |
| 3. 9765 $\frac{5}{8}$ | 8. 723 $\frac{1}{4}$ |
| 4. 735 $\frac{7}{8}$ | 9. 68 $\frac{31}{100}$ |
| 5. 171 $\frac{221}{224}$ | 10. 82 $\frac{11}{120}$ |

Case V, page 25.

- | | |
|----------------------|----------------------|
| 1. $694\frac{1}{7}$ | 6. $13\frac{5}{17}$ |
| 2. $68\frac{1}{7}$ | 7. $61\frac{1}{2}$ |
| 3. $1651\frac{1}{2}$ | 8. $161\frac{1}{2}$ |
| 4. $1668\frac{1}{7}$ | 9. $26\frac{1}{7}$ |
| 5. $268\frac{1}{2}$ | 10. $483\frac{1}{2}$ |

LEAST COMMON DENOMINATOR, page 27.

- | | |
|---|---|
| 1. $\frac{1}{18}, \frac{7}{18}, \frac{10}{18}$ | 6. $\frac{4}{48}, \frac{4}{48}, \frac{5}{48}, \frac{1}{24}$ |
| 2. $\frac{1}{12}, \frac{1}{12}, \frac{7}{12}$ | 7. $\frac{1}{40}, \frac{1}{40}, \frac{3}{40}$ |
| 3. $\frac{1}{10}, \frac{1}{10}, \frac{1}{10}, \frac{1}{10}$ | 8. $\frac{1}{40}, \frac{1}{40}, \frac{1}{40}, \frac{1}{40}$ |
| 4. $\frac{1}{24}, \frac{1}{24}, \frac{1}{24}$ | 9. $\frac{1}{120}, \frac{1}{120}, \frac{1}{120}$ |
| 5. $\frac{1}{180}, \frac{1}{180}, \frac{1}{180}, \frac{1}{180}$ | 10. $\frac{1}{336}, \frac{1}{336}, \frac{1}{336}$ |

ADDITION OF FRACTIONS, Page 28.

- | | | | |
|--------------------|--------------------|----------------------|------------------------|
| 1. 2 | 6. $1\frac{7}{8}$ | 11. $4\frac{1}{16}$ | 16. $21\frac{1}{36}$ |
| 2. $2\frac{6}{11}$ | 7. $1\frac{1}{2}$ | 12. $5\frac{1}{8}$ | 17. $\frac{3}{4}$ |
| 3. $1\frac{1}{4}$ | 8. $2\frac{1}{4}$ | 13. $10\frac{3}{8}$ | 18. $4\frac{5}{8}$ |
| 4. $1\frac{5}{12}$ | 9. $1\frac{1}{6}$ | 14. $11\frac{1}{6}$ | 19. $59\frac{1}{12}$ |
| 5. $1\frac{1}{6}$ | 10. $2\frac{1}{3}$ | 15. $40\frac{1}{16}$ | 20. $12\frac{87}{160}$ |

SUBTRACTION OF FRACTIONS, pages 29, 30.

- | | | |
|---------------------|----------------------|-----------------------|
| 1. $\frac{2}{11}$ | 12. $2\frac{1}{2}$ | 23. $76\frac{1}{2}$ |
| 2. $\frac{1}{3}$ | 13. $2\frac{1}{4}$ | 24. $82\frac{1}{4}$ |
| 3. $1\frac{6}{11}$ | 14. $6\frac{3}{20}$ | 25. $359\frac{1}{2}$ |
| 4. $1\frac{1}{2}$ | 15. $525\frac{1}{2}$ | 26. $352\frac{7}{2}$ |
| 5. $1\frac{1}{6}$ | 16. $1\frac{1}{6}$ | 27. $267\frac{1}{2}$ |
| 6. $2\frac{1}{4}$ | 17. $4\frac{2}{3}$ | 28. $17\frac{1}{2}$ |
| 7. $2\frac{1}{6}$ | 18. $2\frac{1}{2}$ | 29. $176\frac{1}{15}$ |
| 8. $2\frac{1}{6}$ | 19. $7\frac{1}{2}$ | 30. $334\frac{1}{2}$ |
| 9. $\frac{1}{36}$ | 20. $12\frac{7}{8}$ | 31. $1\frac{1}{5}$ |
| 10. $2\frac{1}{4}$ | 21. $243\frac{1}{2}$ | 32. $7\frac{1}{6}$ |
| 11. $1\frac{1}{15}$ | 22. $70\frac{1}{2}$ | 33. $\frac{2}{3}$ |

DECIMAL FRACTIONS, page 32.

1. Two-tenths. 2. Four-hundredths. 3. One hundred and thirty-eight thousandths. 4. Four thousand five hundred and thirty-one ten-thousandths. 5. Ninety-eight ten thousandths. 6. Six hundred thousandths. 7. Eight thousand and four ten-thousandths. 8. Four thousand and ten ten-thousandths. 9. Twenty-one thousand and forty-two hundred-thousandths. 10. Fourteen millionths. 11. One million seven hundred and forty-three thousand one hundred and ninety-six ten millionths. 12. Eight thousand nine hundred and eighty ten-millionths. 13. Forty-eight, and seven thousand eight hundred and four ten-thousandths. 14. Eighty-three, and eighty-four ten-thousands. 15. One hundred and twenty-one, and eighteen thousand and six hundred-thousandths. 16. Three hundred and forty-five, and eighteen millionths. 17. Nine hundred and nine, and nine hundred and ninety-nine millionths. 18. One thousand two hundred and three, and eighty thousand seven hundred and sixty-four millionths.

Pages 32 and 33.

- | | | |
|----------|----------------|-----------------------|
| 1. .5 | 6. .5347 | 11. .0007007 |
| 2. .22 | 7. .000088 | 12. 12000.0072101 |
| 3. .087 | 8. 808.008008 | 13. .600607 |
| 4. .0056 | 9. .10057 | 14. 27905.045004 |
| 5. .0304 | 10. 121.121101 | 15. 9700000.000453168 |

Page 34.

- | | | | |
|----------|--------------|----------|--------------|
| 1. .6 | 7. .52 | 13. .3 | 19. .916 |
| 2. .75 | 8. .53125 | 14. .6 | 20. .428571 |
| 3. .5 | 9. .47916+ | 15. .5 | 21. .461538. |
| 4. .375 | 10. .714285+ | 16. .8 | |
| 5. .625 | 11. .3125 | 17. .63 | |
| 6. .4375 | 12. 3.6 | 18. .583 | |

Page 35.

1. $\frac{1}{2}$	10. $\frac{7}{100}$	19. $\frac{1}{11}$
2. $\frac{1}{4}$	11. $\frac{3}{4}$	20. $\frac{1}{11}$
3. $\frac{3}{4}$	12. $\frac{1}{360}$	21. $\frac{9}{11}$
4. $\frac{1}{11}$	13. $\frac{1}{11}$	22. $\frac{1}{11}$
5. $\frac{1}{10}$	14. $\frac{1}{11}$	23. $\frac{7}{11}$
6. $\frac{1}{10}$	15. $\frac{1}{180}$	24. $\frac{1}{11}$
7. $\frac{1}{10}$	16. $\frac{1}{11}$	25. $\frac{1}{36}$
8. $2\frac{1}{11}$	17. $\frac{1}{11}$	26. $\frac{1}{11}$
9. $16\frac{1}{11}$	18. $\frac{1}{11}$	27. $\frac{1}{11}$

ADDITION AND SUBTRACTION OF DECIMALS, pages 36 and 37.

1. 6913.3477	10. 12.775	20. .0099
2. 8458.9734	12. 10.67803712	21. 10.0018
3. 39.0374625	13. 38.885	22. .356
4. 25.563375	14. 4.887	23. .95
5. 7300.429	15. 11.2632	24. .238857142
6. 40.39496	16. 10.3029	25. 1.251
7. 800.227238	17. 102.00169	26. 4.9225
8. 920.1754	18. .0092	
9. 2.52087	19. .0476	

MULTIPLICATION OF DECIMALS, page 38.

1. .8636	6. 18.58922	11. .000064	16. .552
2. .05824	7. .00000114	12. .001478741	17. 1.55295
3. 18	8. 472.619	13. .020736	18. 1.95
4. .0015	9. .0441	14. 40.10416	19. 2.39015
5. 6.4	10. 28	15. 63.0416	20. 5.0923076

Page 39.

1. 45	4. 62.5	7. \$486.663	10. 4866666.663
2. .7	5. 4866.6	8. \$6750.	11. 671428.571428
3. 17050	6. 48333.3	9. \$1737.50	

Page 39.

1. 644.1	4. 1806	7. 24075	10. 247.5
2. 1.3365	5. 449.025	8. .08	
3. 199.625	6. 48.75	9. 55125	

DIVISION OF DECIMALS, pages 40 and 41.

1. 70	9. .005	17. 17.57
2. 42	10. .092268	18. 3875.
3. 3.13	11. 450	19. .3
4. 7.191	12. .004485+	20. 1237
5. 1.122	13. 9706.36	21. .00007
6. 440	14. 1035.10428571	22. 718.02288+
7. 63.445	15. 955.305	
8. .0084	16. 88.252887+	
1. 342.55	4. .0835	7. 7 cents.
2. .5775	5. .000075	
3. 1.444755	6. .0586372	

REDUCTION OF DENOMINATE NUMBERS, Pages 56, 57, 58.

1. 6144	17. 144000	33. 3267	49. 633½
2. 78235	18. 1615	34. 18585600	50. 144
3. 18240	19. 1842	35. 69984	51. 30
4. 26781	20. 144000	36. 480	52. 151½
5. 30778	21. 31948	37. 4015967044	53. 544
6. 882	22. 168	38. 128000	54. 826
7. 27300	23. 1500	39. 40000	55. 2576
8. 47825	24. 8330	40. 270	56. 684113¼
9. 16000	25. 1020	41. 14760000	57. 20781756
10. 17730	26. 2240	42. 559872	58. 1248009
11. 7700	27. 220	43. 724032	59. 172225
12. 194428	28. 248160	44. 600	60. 210290
13. 576000	29. 997057	45. 1500	61. 2400
14. 2734	30. 20259½	46. 702	62. 250
15. 31022	31. 253004	47. 180	63. 181
16. 8773.	32. 900	48. 400	64. 184

Pages 59 and 60.

1. £12. 12s	7. 273
2. £325. 19s 7d	8. 478.25
3. 19	9. 16
4. £27 17s 11¼d	10. £17 7s 3d
5. £128 4s 10d	11. 3 tons, 17 cwt.
6. 18s 4½d	12. 759 lb. 7 oz. 12 dr.

- | | |
|--|-------------------------------|
| 13. 18 | 39. 4 |
| 14. 24 cwt. 1 qr. 18 lb. | 40. 27 |
| 15. 13 tons, 16 cwt. 3 qr. 26 lb. | 41. 147 a. 6 sq. ch. |
| 16. 4 tons, 7 cwt. 73 lb. | 42. 12 |
| 17. 25 | 43. 419 |
| 18. 6 lb. 8 oz. 15 pwt. | 44. 75 |
| 19. 3 oz. 16 pwt. 18 gr. | 45. 15 |
| 20. 25 | 46. 21 gal. 3 qrt. 1 pt. 2 g. |
| 21. 5 lb. 6 oz. 4 dr. 1 scr. 8 gr. | 47. 216 |
| 22. 7 | 48. 480 |
| 23. 25 | 49. 760 |
| 24. 245 | 50. 120 |
| 25. 17 | 51. 25 |
| 26. 7 | 52. 126 |
| 27. 40 | 53. 17 |
| 28. 47 | 54. 12 bush. 3 pk. 5 qrt. |
| 29. 15 m. 5 f. 35 rd. 3 yd. 1 ft. 7 in | 55. 40 bush. 1 pk. |
| 30. 3 m. 6 f. 27 rd. 4 yd. | 56. 1873 |
| 31. 31 miles, 50 chains, 4 links | 57. 240 d. 12 h. 42 m. 36 s. |
| 32. $11\frac{1}{4}$ | 58. 2 y. 136 d. 16 h. 9 m. |
| 33. 12 | 59. $47^{\circ} 50' 25''$ |
| 34. 6 | 60. $58^{\circ} 24' 50''$ |
| 35. 54 | 61. 50 |
| 36. 3 | 62. $12\frac{1}{2}$ |
| 37. 1 sq. m. 37 sq. rd. 20 sq. yd. | |
| 38. 20 [6 sq. ft. 112 sq. in. | |

MISCELLANEOUS EXERCISES, pp. 60-64.

- | | |
|---------------------------------------|-----------------------------------|
| 1. 5671 | 12. 99 m. 6 f. 29 rd. 3 yd. 0 ft. |
| 2. 15763 | 13. $10\frac{2}{3}$ [6 in. |
| 3. 7 t. 7 cwt. 96 lb. | 14. $62\frac{1}{2}$ |
| 4. £55 7s. 1d. | 15. 14000 |
| 5. 95 t. 10 cwt. 75 lb. | 16. 12s. 6d. |
| 6. 103654 | 17. 8s. 9d. |
| 7. 16 | 18. 17s. 6d. |
| 8. 31590 | 19. 13s. 4d. |
| 9. 17350 | 20. 56 |
| 10. 76 a. 1 r. 35 sq. rd. 19 sq. yds. | 21. $\frac{1}{4}$ |
| 11. 640000 [2 sq. ft. 119 sq. in. | 22. 11 cwt. $66\frac{2}{3}$ lb. |

- | | |
|-------------------------------|---|
| 23. 2 ft. 8 $\frac{1}{2}$ in. | 54. 6s. 8d. |
| 24. 8 oz. | 55. 13s. 4d. |
| 25. 5 $\frac{7}{13}$ d. | 56. 8s. 4d. |
| 26. 88 $\frac{1}{2}$ | 57. 15 cwt. 93 lb. 11 oz. 3 $\frac{1}{2}$ dr. |
| 27. $\frac{2}{3}$ | 58. 17 lb. 12 oz. 8 dr. |
| 28. $\frac{3}{8}$ | 59. 14 oz. 5 dr. |
| 29. $\frac{3}{4}$ | 60. 8 oz. 2 pwt. |
| 30. $\frac{3}{8}$ | 61. 19 pwt. 12 $\frac{1}{2}$ gr. |
| 31. $\frac{1}{24}$ | 62. 6 dr. 0 scr. 19 $\frac{1}{2}$ gr. |
| 32. $\frac{4}{10}$ | 63. 2 oz. 0 dr. 2 scr. 18·512 gr. |
| 33. $\frac{1}{73}$ | 64. 9s. 6d. |
| 34. $\frac{1}{12}$ | 65. 77 $\frac{1}{2}$ lb. |
| 35. $\frac{7}{8}$ | 66. 6 $\frac{1}{2}$ d. |
| 36. $\frac{5}{8}$ | 67. 68 lb. 7 oz. 3 $\frac{1}{2}$ dr. |
| 37. $\frac{7}{8}$ | 68. ·29375 |
| 38. $\frac{1}{10}$ | 69. ·875 |
| 39. $\frac{3}{8}$ | 70. ·76875 |
| 40. $\frac{3}{8}$ | 71. ·6625 |
| 41. $\frac{1}{18}$ | 72. ·840625 |
| 42. $\frac{1}{136}$ | 73. ·04375 |
| 43. $\frac{2}{3}$ | 74. ·0072916 |
| 44. $\frac{1}{10}$ | 75. ·45 |
| 45. $\frac{1}{108}$ | 76. ·06 |
| 46. $\frac{1}{1633}$ | 77. ·9875 |
| 47. $\frac{5}{8}$ | 78. ·04583 |
| 48. $\frac{7}{8}$ | 79. ·166 |
| 49. $\frac{1}{11}$ | 80. ·696875 |
| 50. 17s. 6d. | 81. ·375 |
| 51. 12s. 6d. | 82. ·115625 |
| 52. 17s. 4 $\frac{1}{2}$ d. | 83. ·242245370 |
| 53. 11s. 7 $\frac{1}{2}$ d. | |

ADDITION OF DENOMINATE NUMBERS, pp. 64, 65, 66.

- | | |
|---------------------------------|------------------------------|
| 1. £368 19s. 1 $\frac{1}{2}$ d. | 5. 66 cwt. 2 qr. 23 lb. |
| 2. £452 13s. 11d. | 6. 34 t. 17 cwt. 0 qr. 7 lb. |
| 3. £515 2s. 10 $\frac{1}{2}$ d. | 7. 17 t. 8 cwt. 82 lb. |
| 4. £44 15s. 9d. | 8. 89 lb. 10 oz. 2 dr. |

- | | |
|-------------------------------------|--|
| 9. 77 lb. 8 oz. | 20. 9s. $4\frac{1}{2}$ d. |
| 10. 28 lb. 4 oz. 0 dr. 1 scr. 4 gr. | 21. 9s. $3\frac{1}{4}$ d. |
| 11. 750 m. 2 f. 6 rd. | 22. 12 cwt. 1 lb. 3 oz. $0\frac{1}{4}$ dr. |
| 12. 86 yd. 2 ft. 11 in. | 23. 4 f. 13 rd. 4 yd. 2 ft. $9\frac{3}{4}$ in. |
| 13. 157 sq. rd. 6 sq. yd. 3 sq. ft. | 24. 12 cwt. 94 lb. 6 oz. $10\frac{3}{4}$ dr. |
| 14. 449 a. 8 ch. 516 l. [98 sq. in. | 25. 12s. $1\frac{1}{2}$ d. |
| 15. 106 b. 3 qrt. | 26. 9 oz. 1 pwt. $12\frac{3}{4}$ gr. |
| 16. 153 t. 3 cwt. 2 qr. 1 lb. | 27. 16s. 5d. |
| 17. 3 C. $54^{\circ} 56' 23''$ | 28. 16s. 3d. |
| 18. 93 y. 267 d. 23 h. 37 m. 36 s. | 29. 18 cwt. 3 qr. 14 lbs. |
| 19. 94 yd. 2 ft. 10 in. | 30. 8 cwt. 76 lb. 9 oz. |

SUBTRACTION OF DENOMINATE NUMBERS, pp. 67, 68, 69.

- | | |
|----------------------------|---------------------------------|
| 1. £596 15s. 6d. | 15. £14 16s. 8d |
| 2. 17 t. 18 cwt. 46 lb. | 16. £7 3s. $9\frac{1}{2}$ d. |
| 3. 1245 m. 7 f. 36 rd. | 17. £94 1s. $2\frac{3}{4}$ d. |
| 4. 489 a. 2 roods, 25 rd. | 18. £6 11s. $10\frac{1}{4}$ d. |
| 5. $15^{\circ} 24' 19''$ | 19. 7 cwt. $44\frac{1}{4}$ lb. |
| 6. 3967 d. 8 h. 38 m. 5 s. | 20. 8 oz. 16 pwt. 6 gr. |
| 7. 5 h. 41 m. 39 s. | 21. 1 qrt. $0\frac{2}{3}$ p. |
| 8. 7 m. 16 d. | 22. 4s. $9\frac{1}{2}$ d. |
| 9. 9 m. 29 d. | 23. 3s. $8\frac{3}{4}$ d. |
| 10. 7 h. 43 m. 55 s. | 24. 3s. 10d. |
| 11. $37^{\circ} 50' 14''$ | 25. 14s. $5\cdot 28$ d. |
| 12. 8 s. $6\frac{1}{2}$ d. | 26. 12 cwt. 93 lb. 2 oz. 12 dr. |
| 13. 5 cwt. 1 qr. 18 lb. | 27. 2 qrt. 1 pt. 2 gills. |
| 14. 5 cwt. 2 qr. 16 lb. | 28. 11 cwt. 3 qr. 24 lb. |

MULTIPLICATION OF DENOMINATE NUMBERS, pp. 69, 70, 71.

- | | |
|------------------------------------|-----------------------------------|
| 1. £193 15s. $4\frac{1}{2}$ d. | 9. 93 b. 2 pk. 3 qrt. |
| 2. £704 13s. $9\frac{3}{4}$ d. | 10. 22 h. 6 m. 48 s. |
| 3. £1771 5s. 3d. | 11. 50 h. 30 m. 25 s. |
| 4. 29 t. 6 cwt. 45 lb. | 12. 24 h. 42 m. 20 s. |
| 5. 106 lb. 6 oz. 14 dr. | 13. £280 3s. 9d. |
| 6. 51 lb. 9 oz. 11 pwt. 3 gr. | 14. £965 17s. $4\frac{1}{2}$ d. |
| 7. 40 lb. 2 oz. 0 dr. 1 scr. 5 gr. | 15. £1431 16s. $10\frac{3}{4}$ d. |
| 8. 47 m. 3 f. | 16. 1564 t. 19 cwt. 24 lb. |

- | | |
|---------------------------|-------------------------|
| 17. 643 cwt. 3 qr. 24 lb. | 21. 96 a. 90 sq. rd. |
| 18. 1779 yd. 0 ft. 6 in. | 22. 96 h. 24 m. 10 s. |
| 19. 3332 lb. 3 oz. 4 dr. | 23. 669 gal. 2 qrt. |
| 20. 8 t. 7 cwt. 9 lb. | 24. 49 t. 0 cwt. 20 lb. |

DIVISION OF DENOMINATE NUMBERS, pp. 71, 72, 73.

- | | |
|------------------------------|---------------------------------------|
| 1. £95 7 10½ | 13. 1 t. 3 cwt. 41 lb. |
| 2. £115 18 1½ | 14. 5 oz. 8 pwt. 8 gr. |
| 3. £192 0 1½ | 15. 15 b. 7½ qrt. |
| 4. 2 t. 6 cwt. 38 lb. | 16. 9 h. 40 m. |
| 5. 13 lb. 7 oz. 2 dr. | 17. 2 b. 2 pk. 5½ qrt. |
| 6. 8 lb. 11 oz. 2 pwt. 7 gr. | 18. 15 t. 0 cwt. 3 qr. 14 lb. |
| 7. 1 cwt. 3 qr. 20 lb. | 19. 32258 lb. 0 oz. 15 pwt. 11½ gr. |
| 8. £3 19 5½ | 20. 9 cwt. 3 qr. 14 lb. |
| 9. £8 8 1½ | 21. 5 lb. 11 oz. 18 pwt. 5½ gr. |
| 10. £12 10 8¼ | 22. 17 t. 14 cwt. 3 qr. 18 lb. 14 oz. |
| 11. 18 t. 12 cwt. 61 lb. | 23. 12 m. 3 f. 19 rd. |
| 12. 49 lb. 11 oz. 12 gr. | 24. 24 a. 8⅓ sq. ch. |

THE CENTAL, p. 74.

- | | |
|------------|-------------|
| 1. \$3 | 1. 44½ cts. |
| 2. \$7 | 2. \$4.80 |
| 3. \$2 | 3. \$7.20 |
| 4. \$2.50 | 4. \$1.26 |
| 5. \$1.32⅔ | |
| 6. \$1.50 | |

LONGITUDE AND TIME, pp. 77, 78.

- | | |
|----------------------------|----------------|
| 1. 3 h. 1 m. 24 s. | 1. 2° 9' |
| 2. 1 h. 47 m. 16 s. | 2. 4° 6' |
| 3. 9 m. 44 s. | 3. 66° W. |
| 4. 7 h. 45 m. 44 s. A. M. | 4. 73° 44' W. |
| 5. 11 h. 31 m. 56 s. A. M. | 5. 83° 55' E. |
| 6. 0 h. 3 m. 28 s. P. M. | 6. 130° 45' W. |
| 7. 0 h. 21 m. 8 s. P. M. | |
| 8. 2 h. 26 m. | |

ALICQUOT PARTS, pp. 80, 81.

- | | | |
|-------------|-------------------|---------------------|
| 1. 83 cts. | 35. £1 0s. 5d. | 68. £1 17s. 6d. |
| 2. \$1.69 | 36. £0 18s. 4½d. | 69. £24 7s. 6d. |
| 3. \$1.13 | 37. £1 11s. 10½d. | 70. £19 10s. |
| 4. \$5.40 | 38. £0 13s. 4½d. | 71. £55 2s. 6d. |
| 5. \$4.25 | 39. £1 3s. 4½d. | 72. £48 |
| 6. \$4.81 | 40. £2 11s. 4½d. | 73. £680 1s. 3d. |
| 7. \$0.89 | 41. £2 16s. 9¾d. | 74. £381 5s. |
| 8. \$0.42 | 42. £3 2s. 10½d. | 75. £316 2s. 6d. |
| 9. \$0.74 | 43. £3 2s. 7¾d. | 76. £637 6s. 3d. |
| 10. \$0.95 | 44. £4 12s. 5½d. | 77. £119 12s. 6d. |
| 11. \$1.09 | 45. £7 11s. 2½d. | 78. £483 17s. 6d. |
| 12. \$0.77 | 46. £0 9s. 8½d. | 79. £35 6s. 5d. |
| 13. \$1.01 | 47. £0 7s. 1½d. | 80. £218 10s. |
| 14. \$5.46 | 48. £3 3s. 8½d. | 81. £697 0s. 6d. |
| 15. \$5.43 | 49. £2 10s. 1½d. | 82. £63 18s. 9d. |
| 16. \$13.81 | 50. £3 12s. 2½d. | 83. £88. |
| 17. \$9.69 | 51. £180 | 84. £34 4s. 6d. |
| 18. \$7.56 | 52. £109 | 85. £102 19s. |
| 19. \$3.39 | 53. £435 | 86. £178 6s. 8d. |
| 20. \$2.26 | 54. £17 12s. 6d. | 87. £36 5s. |
| 21. \$1.75 | 55. £24 15s. | 88. £132 3s. 9d. |
| 22. \$4.50 | 56. £765 | 89. £141 |
| 23. \$8.44 | 57. £1610 | 90. £448 11s. 10½d. |
| 24. \$9.30 | 58. £136 13s. 4d. | 91. £1 5s. 7¾d. |
| 25. \$13.30 | 59. £2 9 1s. 3d. | 92. £1 1s. 2½d. |
| 26. \$15.38 | 60. £154 13s. 4d. | 93. \$12.76 |
| 27. \$24.04 | 61. £236 13s. 4d. | 94. \$9.47 |
| 28. \$2.27 | 62. £236 10s. | 95. \$12.60 |
| 29. \$9.78 | 63. £550 | 96. \$3.65 |
| 30. \$7.81 | 64. £105 | 97. \$6.16 |
| 31. \$24.48 | 65. £43 2s. 6d. | 98. \$4.34 |
| 32. \$6.22 | 66. £26 5s. | 99. \$6.44 |
| 33. \$10.12 | 67. £84. 7s. 6d. | 100. \$1.92 |
| 34. \$20.40 | | |

PERCENTAGE, pp. 85, 86, 87.

1. 37.80	21. \$250	41. 15 %
2. 37.80	22. \$760.40	42. $1\frac{1}{2}$ %
3. 45.625	23. \$964.56	43. $2\frac{1}{2}$ %
4. 317.76	24. 321.05	44. 70 %
5. \$34.256	25. 97	45. $7\frac{1}{2}$ %
6. \$129.33 $\frac{1}{4}$	26. 1650.45	46. 75 %
7. \$8.64	27. 2460.20	47. 5 %
8. \$14.62 $\frac{1}{2}$	28. \$17.40	48. $\frac{1}{2}$ %
9. \$1520	29. \$460.50	49. $25\frac{1}{2}$ %
10. \$291.93	30. \$450	50. $\frac{1}{4}$ %
11. 336.60	31. 3600	51. $\frac{3}{8}$ %
12. 3120	32. \$85	52. $\frac{5}{8}$ %
13. \$812.50	33. \$640.80	53. \$203
14. \$431.25	34. 1200	54. \$34.40
15. \$16.317	35. \$1200	55. \$1300
16. 789.75	36. 36000	56. $4\frac{1}{2}$ %
17. \$625	37. 6%	57. $21\frac{1}{4}$ %
18. \$789	38. $17\frac{3}{4}$ %	58. 15 %
19. \$325	39. 10%	59. \$109.37 $\frac{1}{2}$
20. \$15	40. 11 %	60. 53 $\frac{1}{4}$

PERCENTAGE, pp. 88, 89, 90.

61. \$775.75	76. \$1250	91. $12\frac{1}{2}$ %
62. \$484.42	77. \$840	92. $1\frac{1}{4}$ %
63. \$869.32	78. \$84.45	93. 423
64. \$1386.18	79. 1800	94. 684
65. 254.61	80. \$4.44 $\frac{1}{2}$	95. 42
66. 546.75	81. 20%	96. 1191
67. 46.08	82. 5%	97. 422.4
68. 638.40	83. 10%	98. \$328.95
69. 240.90	84. $8\frac{1}{2}$ %	99. \$350.58
70. \$4.86 $\frac{1}{4}$	85. $\frac{1}{2}$ %	100. \$177.18 $\frac{1}{2}$
71. \$725	86. $\frac{1}{2}$ %	101. 240
72. 800	87. $\frac{1}{4}$ %	102. 325
73. 25	88. 80%	103. 600
74. 540	89. 8%	104. \$382.20
75. 600	90. $\frac{1}{2}$ %	105. \$2000

106. \$5339.02 $\frac{1}{4}$	118. 2 $\frac{1}{2}$ %	130. \$171.50
107. \$80	119. 15 %	131. 34 $\frac{1}{2}$ %
108. \$10	120. 16 $\frac{2}{3}$ %	132. $\frac{1}{4}$ % prem.
109. \$256.12	121. 4 $\frac{1}{2}$ %	133. \$640.10
110. \$960	122. \$720	134. 11 %
111. 5 %	123. \$167.76	135. 16 $\frac{2}{3}$ %
112. 6 %	124. \$1620	136. 5 %
113. 25 %	125. \$110	137. \$82800
114. 40 %	126. \$6500	138. \$47.60
115. 12 $\frac{1}{2}$ %	127. 13 $\frac{1}{2}$ %	139. 41 %
116. 33 $\frac{1}{3}$ %	128. \$3.50	140. 20 %
117. 30 %	129. 50 %	141. \$2493.35

Pages 92, 93, 94, 95.

1. 25.2	26. 780	51. \$609.30
2. 483	27. 170	52. \$564.48
3. 344.5	28. 140	53. \$425.25
4. \$150.80	29. 195	54. \$4.59 $\frac{1}{2}$
5. \$680.40	30. 108	55. 2010
6. \$12612.30	31. 192.5	56. 1203
7. \$4807.216	32. \$344.40	57. \$1682.10
8. \$565.49 $\frac{1}{2}$	33. \$61.25	58. \$480.30
9. \$1635	34. \$9.80	59. \$1903.80
10. 528	35. 648	60. \$226.69
11. 1178	36. 614.56	61. \$1084.05
12. \$2.94	37. 1029.5	62. \$465.39
13. \$40.89	38. \$2154.60	63. \$882.66
14. \$1.38	39. \$2.183	64. \$776.16
15. \$1547	40. \$7672	65. \$494.94
16. \$882.70	41. \$15.996	66. \$5.36
17. \$581.25	42. \$3116	67. \$4.90
18. \$456.37	43. \$1302.71	68. \$5253.90
19. 480	44. \$2226	69. \$4.86 $\frac{2}{3}$
20. 2590	45. 88.5	70. \$4.83 $\frac{1}{3}$
21. 1080	46. 2940	71. \$4.90
22. \$2600	47. 3620.6	72. \$4.87 $\frac{1}{3}$
23. \$959.14	48. \$10.56	73. \$4.83 $\frac{2}{3}$
24. \$706.05	49. \$281.25	74. \$4.87 $\frac{2}{3}$
25. \$121.12 $\frac{1}{2}$	50. \$41.40	75. \$2005.50

76. \$3385.80	82. \$1749	88. \$248.10
77. \$124.37½	83. \$2312.50	89. \$90
78. \$957.60	84. \$8062.50	90. \$1100.50
79. \$74.85	85. 470	91. \$14.40
80. \$83.89½	86. 1200	92. \$109.37½
81. \$674.90	87. 4500	

INTEREST I, p. 98.

1. \$45	5. \$10.53	9. \$62.69
2. \$1.75	6. \$54	10. \$41.23
3. \$8.40	7. \$23.75	
4. \$18	8. \$57.03	

II.

1. \$83	5. \$4.35	9. \$527.47
2. \$199.50	6. \$147.68	10. \$152.19
3. \$204	7. \$297.08	11. \$371.72
4. \$86.34	8. \$385.90	12. \$688.86

III.

1. \$25.90	7. \$87.50	13. \$91.09
2. \$13.68	8. \$26.25	14. \$79.86
3. \$9.26	9. \$72.34	15. \$19.10
4. \$8.87	10. \$107.25	16. \$17.57
5. \$110.18	11. \$20.34	17. \$448.48
6. \$65.65	12. \$156.95	18. \$83.85

Page 99.

19. \$4.10	25. \$29.09	31. \$853.50
20. \$52.39	26. \$31.10	32. \$2481.24
21. \$14.98	27. \$1.44	33. \$204.22
22. \$1.53	28. \$12.01	34. \$13.19
23. \$37.20	29. \$242.64	35. \$69.65
24. \$4.14	30. \$44.79	36. \$197.09

IV. Page 101.

1. \$2.466	5. \$8.582	9. \$4.145
2. \$2.655	6. \$2.693	10. \$36.405
3. \$1.166	7. \$288	11. \$2.764
4. \$6.673	8. \$14.475	12. \$3.945

Pages 103 and 104.

13. \$3.95	31. \$1.45	49. \$5.56
14. \$5.39	32. \$2.32	50. \$8.28
15. \$29	33. \$2.69	51. \$23.18
16. \$82	34. \$91	52. \$2.39
17. \$84	35. \$8.91	53. \$81.75
18. \$94	36. \$3.74	54. \$33.60
19. \$88.04	37. \$80	55. \$203.35
20. \$2.72	38. \$3.86	56. \$36.78
21. \$17	39. \$40.77	57. \$1.35
22. \$8.14	40. \$2.40	58. \$12.70
23. \$53	41. \$1.56	59. \$45.55
24. \$47	42. \$16.87	60. \$2.18
25. \$29.31	43. \$1.40	61. \$3.73
26. \$15.51	44. \$1.39	62. \$19
27. \$97.73	45. \$57.11	63. \$98
28. \$4.62	46. \$2.42	64. \$10.62
29. \$83.33	47. \$5.38	65. \$37.94
30. \$45	48. \$1.91	66. \$19.50

V. Page 105.

1. \$60	5. \$871.31	9. \$1600
2. \$40	6. \$225	10. \$29827.96
3. \$204	7. \$480	11. \$4210.64
4. \$12107.84	8. \$3228.33 $\frac{1}{3}$	12. \$4625.01

VI. Page 106.

1. \$2700	5. \$632	9. \$248.25
2. \$148.50	6. \$1200	10. \$1110
3. \$750	7. \$387.40	11. \$980.40
4. \$595.28	8. \$600	12. \$4000

VII.

1. 5	5. 9 $\frac{1}{2}$	9. 8
2. 12	6. 7	10. 8 $\frac{1}{3}$
3. 8	7. 3 $\frac{1}{2}$	11. 8
4. 10	8. 7	12. 6

VIII Page 107.

- | | | |
|-------------------------|--------------------|-----------------|
| 1. 3 years | 5. 3 m. 18 d. | 9. 187 |
| 2. $2\frac{1}{2}$ years | 6. 2 y. 1 m. 24 d. | 10. 16 y. 8 m. |
| 3. 4 y 8 m. 10 d. | 7. 84 | 11. 33 y. 4 m. |
| 4. 8 m. 20 d. | 8. 65 | 12. Sept. 16/82 |

ACCOUNTS CURRENT, pp. 111 and 112.

- | | | |
|-------------|--------------|------------|
| 1. \$416.85 | 3. \$609.17 | 5. \$24.59 |
| 2. \$658.74 | 4. \$1259.85 | 6. \$53.71 |

DISCOUNT AND PRESENT WORTH, pp. 113 and 114.

- | | | |
|---------------|--------------|--------------------|
| 1. \$200 | 7. \$576.46 | 13. \$1029.13 |
| 2. \$80 | 8. \$545.45 | 14. Cash, by \$200 |
| 3. \$126.30 | 9. \$600 | 15. \$22587.66 |
| 4. \$813.01 | 10. \$450 | 16. \$865.38 |
| 5. \$11538.46 | 11. \$534.98 | 17. \$706.54 |
| 6. \$3905.83 | 12. \$1000 | 18. \$1201.92 |

COMPOUND INTEREST, p. 116.

- | | | |
|--------------|---------------|----------------|
| 1. \$85.87 | 10. \$931.78 | 19. \$4383.91 |
| 2. \$78.65 | 11. \$1390.15 | 20. \$2665.84 |
| 3. \$59.55 | 12. \$562.75 | 21. \$14033.97 |
| 4. \$194.25 | 13. \$695.56 | 22. \$138.14 |
| 5. \$1021.03 | 14. \$1104.48 | 23. \$238.66 |
| 6. \$1418.52 | 15. \$559.74 | 24. \$138.02 |
| 7. \$1804.36 | 16. \$941.50 | 25. \$1012.83 |
| 8. \$2302.03 | 17. \$3195.83 | |
| 9. \$2846.62 | 18. \$1603.57 | |

Page 118.

- | | | |
|------------|--------------|--------------|
| 1. \$1500 | 5. \$120 | 9. \$3247.90 |
| 2. \$10000 | 6. \$233 | 10. \$447.95 |
| 3. \$1600 | 7. \$2194.17 | |
| 4. \$5000 | 8. \$1110.53 | |

ANNUITIES, p. 120.

- | | | |
|---------------|---------------|----------------|
| 1. \$7908.48 | 3. \$60321.01 | 5. \$487834.71 |
| 2. \$47727.10 | 4. \$42063.70 | 6. \$4745.64 |

Page 121.

- | | | |
|----------------|----------------|-----------------------------|
| 1. \$34408.26 | 6. \$9954 | 11. \$50000 |
| 2. \$172920.33 | 7. \$306.60 | 12. \$1666.66 $\frac{2}{3}$ |
| 3. \$45639.81 | 8. \$3060.29 | 13. \$11693.59 |
| 4. \$4120.38 | 9. \$7257.06 | |
| 5. \$3037.15 | 10. \$13710.99 | |

BANK DISCOUNT, pp. 129, 130, 131.

- | | |
|------------------------|------------------------|
| 1. \$10.70 ; \$689.30 | 10. \$11.10 ; \$988.90 |
| 2. \$10.93 ; \$444.87 | 11. \$1481.85 |
| 3. \$11.51 ; \$1188.49 | 12. \$333.20 |
| 4. \$9.81 ; \$629.44 | 13. \$4.34 |
| 5. \$13.92 ; \$496.08 | 14. \$2.85 |
| 6. \$1.33 ; \$127.17 | 15. \$475.54 |
| 7. \$2.80 ; \$290.38 | 16. \$708.53 |
| 8. \$336 ; \$423.64 | 17. \$448.20 |
| 9. \$61 ; \$96.14 | |

Pp. 132 and 133.

- | | | |
|-------------|-------------|--------------|
| 1. \$380.95 | 5. \$619.03 | 9. \$284.06 |
| 2. \$777.43 | 6. \$557.21 | 10. \$300.71 |
| 3. \$809.63 | 7. \$934.83 | |
| 4. \$719.72 | 8. \$380.83 | |

PARTIAL PAYMENTS, pp. 135, 136, 137, 138, 139.

- | | | |
|--------------|--------------|--------------|
| Ex. \$363.70 | 4. \$615.03 | 8. \$151.54 |
| 1. \$259.43 | 5. \$102.03 | 9. \$98.14 |
| 2. \$251.68 | 6. \$1235.32 | 10. \$144.59 |
| 3. \$520.81 | 7. \$58.13 | |

COMMISSION AND BROKERAGE, pp. 142, 143, 144.

- | | | |
|-----------------|------------------------|-----------------------------------|
| 1. \$46.89 | 10. 840 | 19. \$3103.13 |
| 2. \$10.50 | 11. \$4568.27 | 20. \$86.80 |
| 3. \$11.25 | 12. 12 $\frac{1}{2}$ % | 21. 7000 |
| 4. \$100000 | 13. 15 % | 22. 15070 $\frac{1}{2}$; \$83.47 |
| 5. \$3111.25 | 14. £25 18s. 10d. | 23. \$103.64 |
| 6. \$3920.63 | 15. £38 14s. 7d. | 24. \$28800 |
| 7. 2.352 % | 16. 5 % | 25. \$9955.50 |
| 8. \$950 ; \$38 | 17. 3072 ; \$11.52 | 26. 186005 |
| 9. \$760 ; \$19 | 18. \$1720.95 | |

STOCKS AND BONDS, pp. 148 to 152.

- | | | |
|----------------------------|--|--|
| 1. \$108 | 25. \$21.25 | 49. \$60 |
| 2. \$220 | 26. \$125 | 50. \$5880 |
| 3. \$862.50 | 27. \$73.44 | 51. 5 % |
| 4. \$1542 | 28. \$65.55 | 52. 25 % |
| 5. \$3750 | 29. \$12.92 | 53. $33\frac{1}{3}$ % |
| 6. \$5340 | 30. \$24000 ; \$37.50 | 54. 60 % |
| 7. \$785.40 | 31. $3\frac{1}{2}$ % ; \$36.40 | 55. 1.20 |
| 8. \$5474.92 $\frac{1}{2}$ | 32. \$75000 | 56. 1.33 $\frac{1}{3}$ |
| 9. \$343.20 | 33. 7500 | 57. 1.07 $\frac{1}{2}$ |
| 10. \$1200 | 34. \$3985.25 | 58. \$24 |
| 11. \$3336 | 35. 21 | 59. \$28 |
| 12. \$2488.50 | 36. 65 | 60. Inc'd \$78 |
| 13. \$12525 | 37. \$5000 | 61. \$75 |
| 14. \$12555 | 38. \$5000 | 62. 93 $\frac{1}{4}$ |
| 15. \$470 | 39. 85 | 63. \$12832.01 |
| 16. \$4400 | 40. 100 | 64. Lost \$194.66 |
| 17. \$4025 | 41. \$250 | 65. \$153.75 ; |
| 18. \$322.50 | 42. \$560 | Loss \$240.20 |
| 19. \$1237.50 | 43. About 5 $\frac{1}{4}$ % | 66. \$33.75 ; \$4500 |
| 20. \$2018.75 | 44. 6 % bonds by $\frac{1}{16}$ of 1 % | 67. \$126.88 ; |
| 21. \$1005.26 | 45. 8 % | Loss \$253.96 |
| 22. \$404.31 | 46. \$821.25 ; \$41.25 | 68. 8 $\frac{1}{2}$ |
| 23. \$3190.04 | 47. \$771.37 $\frac{1}{2}$ | 69. \$75 ; 2 $\frac{1}{2}$; \$5437.50 |
| 24. \$16140.15 | 48. \$11.69 | 70. \$32000 |

INSURANCE, pp. 154 and 155.

- | | | |
|-------------|---------------------|--------------------------------|
| 1. \$70.40 | 7. \$405 | 13. 45 cents |
| 2. \$1305 | 8. $1\frac{3}{4}$ % | 14. \$6500 |
| 3. \$1900 | 9. $\frac{1}{16}$ % | 15. 40 |
| 4. \$26.25 | 10. \$25.20 | 16. £28 1s. 9 $\frac{1}{4}$ d. |
| 5. \$36 | 11. \$3200 | 17. \$62.63 |
| 6. \$427.75 | 12. \$9000 ; \$4250 | |

PROFIT AND LOSS, pp. 156, 157, 158, 159, 160.

- | | | |
|--------------------------|----------------------------|----------------------------|
| 1. \$78.40 | 21. $2\frac{1}{2}$ | 41. $6\frac{1}{2}$ |
| 2. \$8.55 | 22. \$20 | 42. $7\frac{3}{4}$ cts. |
| 3. \$5.40 | 23. \$120 | 43. $24\frac{1}{2}$ |
| 4. \$19.50 | 24. \$5 | 44. \$3.65 |
| 5. \$36 | 25. \$3.25 | 45. \$7.50 gain |
| 6. \$90 | 26. \$1.50 | 46. $42\frac{3}{4}$ |
| 7. \$3.90 | 27. \$608 | 47. $40\frac{3}{4}$ |
| 8. \$6370 | 28. \$1350 | 48. \$6.11 $\frac{1}{2}$ |
| 9. \$6.30 | 29. $33\frac{1}{3}$ | 49. Lost \$270 |
| 10. \$2.33 $\frac{1}{3}$ | 30. 4 % loss | 50. \$5 |
| 11. \$13.44 each | 31. $12\frac{1}{2}$ % gain | 51. Gains $6\frac{1}{4}$ % |
| 12. 15 | 32. $32\frac{1}{2}$ % | 52. $11\frac{1}{2}$ |
| 13. 6 | 33. 4 % loss | 53. \$700 |
| 14. 25 | 34. 16 % loss | $16\frac{2}{3}$ % |
| 15. 15 | 35. 35 | \$122.50 |
| 16. 20 | 36. $13\frac{1}{3}$ | \$17.50 |
| 17. 25 | 37. \$1.32 $\frac{1}{2}$ | 54. 4 |
| 18. $13\frac{2}{3}$ | 38. $12\frac{1}{2}$ | 55. $5\frac{1}{2}$ |
| 19. $12\frac{1}{2}$ | 39. \$750 | 56. $2\frac{3}{4}$ |
| 20. $17\frac{1}{2}$ | 40. \$1540 | |

BANKRUPTCY OR INSOLVENCY, p. 161.

- | | | |
|----------------------|----------------------|-------------|
| 1. Div. 60c. | 4. $73\frac{1}{4}$ % | 6. 21c. |
| A. \$240 | \$995.96 | A. \$226.80 |
| B. \$210 | 5. $52\frac{1}{4}$ % | B. \$178.50 |
| C. \$360 | London, \$11616 | C. \$361.20 |
| 2. 37c. | Glasgow, \$9504 | D. \$331.80 |
| B. \$296 | New York, \$9028.80 | E. \$203.70 |
| C. \$185 | Montreal, \$8448 | |
| D. \$407 | Toronto, \$2323.20 | |
| E. \$222 | Halifax, \$2217.60 | |
| 3. $47\frac{1}{2}$ % | | |
| \$608.95 | | |

DOMESTIC EXCHANGE, pp. 163, 164, 165.

- | | | |
|--------------|--------------|--------------|
| 1. \$3003.75 | 4. \$8435.53 | 7. \$954.23 |
| 2. \$4611.50 | 5. \$1884.88 | 8. \$5875.87 |
| 3. \$5621 | 6. \$7687.02 | 9. \$737.39 |

10. \$5230.29	17. \$2867.83	24. \$865.40
11. \$2781.62	18. \$3747.66	25. \$1986.02
12. \$1275.20	19. \$3921.57	26. \$2789.03
13. \$4626.70	20. \$3620	27. \$966.20
14. \$3896.10	21. \$1824	28. \$3861.54
15. \$3771.03	22. \$8728	29. \$21.08
16. \$2493.75	23. \$2725	\$8453.93

FOREIGN EXCHANGE, pp. 168 to 172.

1. \$98	21. \$155.35	41. \$6164.85
2. \$305	22. \$282.78	42. £170 9s. 2½d.
3. \$231	23. \$95.03	43. 109
4. 334.10	24. \$162.44	44. 109½
5. \$1391.25	25. \$11305.77	45. \$3034.68
6. \$380.75	26. \$343.64	46. \$5996.35
7. \$514.925	27. \$933.19	47. 19½
8. \$818.283	28. \$1021.68	48. 5.22½
9. \$253.475	29. \$1982.67	49. 17949.60 f.
10. \$22.417	30. \$275.89	50. \$1538.53
11. \$71.833	31. \$418.86	51. \$3.26
12. \$197.733	32. \$3568.08	52. \$2312.17
13. \$325.89	33. \$2378.04	53. Lose \$2.34
14. \$80.63	34. \$2550.65	54. \$11.96
15. \$323.91	35. \$930.09	55. £1482 16s. 9d.
16. \$644.86	36. \$1503.74	56. 1083½ roubles
17. \$406.93	37. £203 19s.	57. \$17160.19
18. \$1856.96	38. \$244.44½	58. £17 10s.; \$85.46
19. \$5.50	39. \$8960	59. Via France by \$15.69
20. \$2.12	40. \$466.67	60. £2016 11s. 3½d.

TAXES AND DUTIES, pp. 174, 175, 176, 177, 178.

1. \$123.23	10. \$1182	13. \$311.40;
2. \$2895	11. \$25.01;	nearly 27 %
3. \$315	nearly 26½ %	14. 41; \$513.56;
4. \$233.50	12. \$65.68; X	40.133; \$1.39;
5. \$664.75	1st lot. 28.55 %	\$2.46; \$3.98.
6. \$223.82	2nd do. 34.12 %	
7. \$65.40	3rd do. 28.55 %	
8. \$23	4th do. 23.2 %	
9. \$496.55	Average 26.86 %	

EQUATION OF PAYMENTS, pp. 180 to 185.

- | | | |
|-----------------------|----------------------|-----------------|
| 1. 10 m. 18 d. | 6. $4\frac{1}{2}$ m. | 11. Nov. 4 |
| 2. $14\frac{2}{3}$ m. | 7. 8 m. 15 d. | 12. Nov. 14; |
| 3. 5 m. | 8. August 4. | \$1450.25 |
| 4. 6 m. | 9. March 16, 1883. | 13. Dec. 17/82; |
| 5. 6 m. | 10. Nov. 8 | \$2467.22 |

AVERAGING ACCOUNTS, pp. 188 to 190.

- | | | |
|-------------------|------------------|--------------------|
| 1. Dec. 18, 1881 | 6. Dec. 11, '82 | 11. Feb'y. 17, '83 |
| 2. Jan. 29, '84 | 7. July 9, '85 | 12. Dec. 22, '83 |
| 3. Mar. 21, '84 | 8. Mar. 28, '79 | 13. Oct. 17, '84 |
| 4. Dec. 30, '82 | 9. Aug. 9, '83 | |
| 5. Feb'y. 21, '83 | 10. Jan. 11, '84 | |

ACCOUNTS SALES, pp. 191 to 194.

1. May 19, 1883; \$1796.05
2. \$4471.86, due Jan. 23, '83; \$973.76
3. April 19, 1883; April 21, 1883; \$2413
4. \$59.45 due me.

RATIO AND PROPORTION, pp. 197, 198.

- | | | |
|--------|--------------------|---------------------|
| 1. 72 | 4. 432 | 7. 48 |
| 2. 38. | 5. $82\frac{2}{3}$ | 8. $610\frac{1}{2}$ |
| 3. 192 | 6. $94\frac{1}{2}$ | 9. 209 |

SIMPLE PROPORTION, pp. 200 to 203.

- | | | |
|--------------------------|------------------------------|------------------------------------|
| 1. \$400 | 15. $6\frac{2}{3}$ months | 29. £19 10s. |
| 2. \$14 | 16. 50 days | 30. £5 14s. 7d. |
| 3. \$112.50 | 17. $91\frac{1}{3}$ gal. | 31. $125\frac{1}{4}$ oz. |
| 4. 20 | 18. 12 days | 32. $9\frac{3}{4}$ lbs. |
| 5. \$1260 | 19. 266 days | 33. \$4.24 |
| 6. \$13.50 | 20. 148 | 34. \$34.20 |
| 7. 10 | 21. 385 yds. | 35. £31 17s. $2\frac{1}{4}$ d. |
| 8. \$15 | 22. \$85 | 36. 10 h. 40 m. $36\frac{7}{8}$ s. |
| 9. $93\frac{3}{4}$ feet | 23. 54 h. $22\frac{2}{3}$ m. | 37. 273 miles |
| 10. 3 h. 8 m. 5 s. | 24. $4\frac{2}{3}$ | 38. 5 miles per hour |
| 11. $16\frac{2}{3}$ days | 25. \$109.84 | 39. $32\frac{1}{3}$ |
| 12. 10 | 26. £194 1s. 3d. | 40. 41 a. 3 r. 25 rd. |
| 13. \$7.09 | 27. £15 19s. | 55 a. 3 r. 20 rd. |
| 14. 36 cents | 28. \$4.88 | |

41. $\$86\frac{1}{3}$; $\$121\frac{2}{3}$; 43. 2464 miles 46. Whole, 150;
 $\$190\frac{2}{3}$ 44. $\$4000$; $\$1600$; tin, $37\frac{1}{2}$;
 42. A, $\$1052.63\frac{2}{3}$; $\$2400$ copper, $112\frac{1}{2}$
 B, $\$1578.94\frac{1}{3}$; 45. 1790; 537; 1253 47. $62\frac{1}{2}$
 C, $\$2368.42\frac{1}{3}$

COMPOUND PROPORTION, pp. 205, 206.

- | | | |
|-------------------------|--------------------|--------------------------|
| 1. $\$58.50$ | 7. 15 days | 13. 2 cwt. 2 qr. 8 lb. |
| 2. $50\frac{2}{3}$ days | 8. $5\frac{1}{2}$ | 14. $9\frac{2}{3}$ miles |
| 3. $\$92.59$ | 9. 50 | 15. $\$27.54$ |
| 4. $\$25.20$ | 10. 16 | 16. 26.88 days. |
| 5. 32 | 11. $3\frac{3}{8}$ | |
| 6. 45 | 12. 21 | |

ANALYSIS, pp. 206 to 211.

- | | | |
|---------------------------|------------------------------------|--|
| 1. $\$20.90$ | 24. $\$425$ | 40. A, $35\frac{4}{7}$ miles; |
| 2. $38\frac{1}{4}$ days | 25. $2\frac{1}{2}$ days | B, 45 miles |
| 3. 14 | 26. $14\frac{2}{3}$ days | 41. $369\frac{1}{2}$ superfic'l ft; |
| 4. $\$20$ | 27. 12 feet broken off; | $33\frac{1}{2}$ cubic feet. |
| 5. $\$3.20$ | $13\frac{1}{2}$ " remained | 42. $22\frac{1}{2}$ cents |
| 6. $\$88$ | 28. 8 m. $34\frac{2}{3}$ a. | 43. 16 |
| 7. $\$1.55\frac{1}{2}$ | 29. 2 h. 24 m. | 44. $\$580.54$ |
| 8. $77\frac{2}{3}$ cents | 30. 3 hours | 45. $\$3430$ |
| 9. $39\frac{2}{3}$ cents | 31. A, 10 days; | 46. Each girl, $\$66\frac{2}{3}$; |
| 10. $1\frac{1}{4}$ st. | B, 12 days; | each boy, $\$42\frac{2}{3}$ |
| 11. $1\frac{1}{4}$ yds. | C, 15 days; | 47. $8\frac{2}{3}$ |
| 12. $\$75.44$ | together in 4 days. | 48. $\$1.97\frac{2}{3}$ |
| 13. 25 | 32. $1\frac{1}{2}$ hours | 49. 18; $11\frac{1}{2}$ by $14\frac{2}{3}$ ft. |
| 14. $\$14.12\frac{1}{2}$ | 33. $6\frac{1}{3}$ | 50. $\$329$ |
| 15. $\$4200$ | 34. $71\frac{2}{3}$ | 51. $11\frac{2}{3}$ |
| 16. 36 years | 35. $10\frac{2}{3}$ minutes | 52. $\$4477.50$ |
| 17. A, $\$45$; B, $\$40$ | 36. A, $\$20$; | 53. 80 in the 1st, |
| 18. $\$13440$ | B, $\$55$; | 56 in the 2nd |
| 19. 60 years | C, $\$25$; | 54. A, 18 oxen, |
| 20. $\$15600$ | D, E & F each $\$1200$ | and pay $\$72$ |
| 21. 36 feet | 37. 10 miles per hour | B, 12 oxen, |
| 22. 20 cents | 38. $60\frac{5}{7}$ sec.; 490 yds. | and pay $\$48$. |
| 23. 32 feet | 39. 12 days | |

PARTNERSHIP, pp. 216 to 225.

1. \$1216.30 each
2. John Smith's \$1634.65
Geo. Brown's \$1491.65
3. Miller's \$2264.61½
Manning's \$2094.11½
4. Davis's \$4595.36
Young's \$1860.18
Russell's \$2110.18
5. A's \$11431.38
B's \$11279.75
C's \$11179.75
6. M's \$17531.63
N's \$6257.21
7. Bal. due C, \$815.52
A's interest, \$2356.90
B's interest, \$2664.14
8. M's \$3848.50
N's \$4901.50
9. \$6198.56
10. A, \$1800; B, \$1500;
C, \$2100; D, \$2400
11. The captain, \$980;
the mate, \$420;
each sailor, \$70
12. A, \$400; B, \$320;
C, \$520; D, \$360
13. A, \$1400; B, \$1000;
C, \$800; D, \$950;
E, \$1187.50; F, \$1662.50
14. L, \$2000; M, \$3000;
N, \$2500
15. A's \$400; B's \$850;
C's \$750; D's \$1000
16. A, \$8.32; B, \$7.04;
C, \$4.48
17. A, 60 ft.; B, 80 ft.; C, 100 ft.
18. A's \$360; B's \$490;
C's \$640
19. A, \$340; B, \$297.50;
C, \$212.50
20. A, and B, each \$7.20;
C, \$4.40; D, \$9
21. A, \$384.93; B, \$250.71;
C, \$236.36
22. A, \$2500; B, \$1875;
C, \$1500
23. \$2190
24. A's \$615.97; B's \$581.75;
C's \$602.28
25. A's \$2067.42; B's \$17408.69;
C's \$17358.69
26. A, 3 cents; B, 21 cents
27. A, \$15750; B, \$2250
28. J's \$17909.29;
K's \$20795.45;
L, \$7639.92
29. Due G, \$2420.25;
due H, \$3742.25
E's net cap., \$5173.50
F's net cap., \$4881
30. Samuels receives \$2097.32
Hall pays back \$117.69
31. I's \$4660.31; J's \$2823.18;
K's \$4095.65; L's \$1320.38;
M's \$4183.23
32. A's gain, \$368.43;
B's, \$330.20; C's, \$278.06;
D's, \$243.31
B. is to pay in \$464.80;
C. " " " \$1521.94;
A. is to receive \$1143.43
D. " " " \$843.31
33. P. Ranton pays A. W. Smith
\$9.58½, and James Walker
83½ cents

34. A's \$374.12; B's \$250.41; 37. B. \$5009.42;
 C's \$487.83; D's \$787.24; C. \$1791.80
 E's \$600.40 Mdse., &c., Dr., \$9840;
 35. Smith's \$13296.95½; Cash, Dr., \$2570;
 Wilson's \$14223.04½ Sundry Drs., \$17030;
 36. A's \$16666.66⅔; To Sundry Crs., \$4050;
 B's \$27091.66⅔; " B, Cr., \$12695;
 C's \$2166.66⅔ " C, Cr., \$12695.

GENERAL AVERAGE, pp. 229, 230.

1. 8 %; Vessel pays \$2333.50 3. 23½ %; Ship pays \$7960.83
 A pays \$292 J. W. Roe pays \$1610
 B receives \$2480 Dunn, Lloyd & Co. re-
 C pays \$160 ceive \$1895.83
 D " \$44 Morris, Wright & Co.
 E " \$436 receive \$430
 F receives \$785.50 Smith & Worth re-
 ceive \$7245
 2. 6½ %; Str. pays \$6516
 A receives \$1182.26 4. 4½ %; Ship receives \$1818
 B " \$667.25 A pays \$292.50
 C " \$4666.50 B " \$337.50
 C " \$783
 D " \$405

MISCELLANEOUS EXERCISES FOR COMMERCIAL STUDENTS.

1. Cost 72⅔ cents;
 asking price 84⅔ cents;
 whole gain \$40.91
 2. \$153.37
 3. A, \$5743.12; B, \$6855.06;
 C, \$8303.86; D, \$12214.48;
 E, \$4243.48
 4. Net gain, \$3242.64;
 Smith should pay Jones
 \$2379.12
 5. Loss \$103.20; Agent owes
 town cash \$7.40
 6. \$111.21
 7. \$28017.73
 8. \$5478.01
 J. P. Fowler, Dr., \$5450.62
 Cash Cr., \$5318
 Com. Cr., \$132.62
 Cash Dr., \$5450.62
 J. P. Fowler, Cr., \$5450.62
 9. W. A. Murray & Co., Dr.,
 \$1742.75
 Simpson & Co., Cr.,
 \$1708.58
 Exchange, Cr., \$34.17.
 W. A. Murray & Co., Dr.,
 \$1742.75
 Exchange, Dr., \$35.57.
 Simpson & Co., Cr.,
 \$1778.32.

10. Interest, Dr., \$21.12 July 7. Ross, Winans & Co.,
 Chas. Massey, Cr., \$21.12 Dr., \$5319.79
 Chas. Massey, Dr., Shipment in Co. with Ross,
 \$2006.54 Winans & Co., Cr.,
 A. Cummings, Cr., £411 \$5319.79
 7s. 3½ = 2006.54 When the draft was drawn,
 11. Face of draft, \$10798.67 : Ross, Winans & Co., Dr.,
 May 1. Shipment in Co. with \$105.86
 Ross, Winans & Co., Interest, Cr. \$105.86
 Dr., \$5359.33 Cash, Dr., \$10771.67
 Ross, Winans & Co., Dr., Exchange, Dr., \$13.30
 \$5359.32 Ross, Winans & Co., Cr.,
 Cash, Cr., \$10457.40 \$10784.97
 Commiasion, Cr., \$261.25 12. Jannary 21 ; Nov. 23 ;
 £906 8s. 5½d.

13. 60 ; £620 18s. 7½d.

- March 10. Shipment in Co. with S. Vestry, Dr., \$1564.42;
 Samuel Vestry, Dr., 4 mos., \$1564.41 ;
 Mdse., Cr., \$3068.34 ; Cash, Cr., \$60.49.
 May 19. Samuel Vestry, Dr., £298 14s. 10d. = \$1450.56
 Shipment in Co. with S. Vestry, Cr., \$1450.56
 May. 28. Cash, Dr., \$3014.97 ;
 Samuel Vestry, Cr., \$1564.41
 Samuel Vestry, Cr., £298 14s. 10d. = \$1450.56

14. Net gain, \$6677.71.

On commencing business, Jan. 1,

- | | |
|----------------------------|---------------------------|
| Mdse., Dr., \$7844 | S. North, Cr., \$6000 |
| Cash, Dr., \$5000 | E. Wills, Cr., \$4560.50 |
| Store, &c., Dr., \$3984 | E. Wills, Dr., \$425.80 |
| Bills Rec., Dr., \$1732.50 | Bills Pay., Cr., \$425.80 |
| J. H. Smith, Cr., \$8000 | |

When Geo. Smith was admitted, May 1,

- | | |
|-------------------------|----------------------|
| Cash, Dr., \$5350 | S. North, Cr., \$450 |
| Geo. Smith, Cr., \$4000 | E. Wills, Cr., \$450 |
| J. H. Smith, Cr., \$450 | |

ANSWERS.

When E. Wills retired, June 30,

Interest, Dr., \$194.10	Profit and Loss, Dr., \$500
E. Wills, Cr., \$194.10	E. Wills, Cr., \$500
E. Wills, Dr., \$20.38	E. Wills, Dr., \$4478.42
Interest, Cr., \$20.38	Cash, Cr., \$4478.42

When S. North sold to J. K. White, Nov. 1,

Interest, Dr., \$365.75	J. K. White, Cr., \$5681.35
S. North, Cr., \$365.75	June 30. Expense, Dr., \$500
S. North, Dr., \$34.40	J. H. Smith, Cr., \$500
Interest, Cr., \$34.40	Dec. 31. Expense, Dr., \$500
S. North, Dr., \$5681.35	J. H. Smith, Cr., \$500

Additional interest entries, Dec. 31.

Interest, Dr., \$851.63	J. H. Smith, Dr., \$50.23
J. H. Smith, Cr., \$598.50	Geo. Smith, Dr., \$5.09
Geo. Smith, Cr., \$186.67	Interest, Cr., \$55.32
J. K. White, Cr., \$66.46	

BALANCE SHEET, DEC. 31.

Mdse.....	\$11943 75	Per. Accts., Cr.	\$10711 00
Cash.....	2110 12	Bills Pay.....	4000 00
Bills Rec.....	6400 00	J. H. Smith (net cap.)	10539 17
Store and Furniture.	3850 00	J. K. White (net cap.)	7973 71
Per. Accts., Dr.	14987 50	Geo. Smith (net cap.)	6067 49
	<u>\$39291 37</u>		<u>\$39291 37</u>

